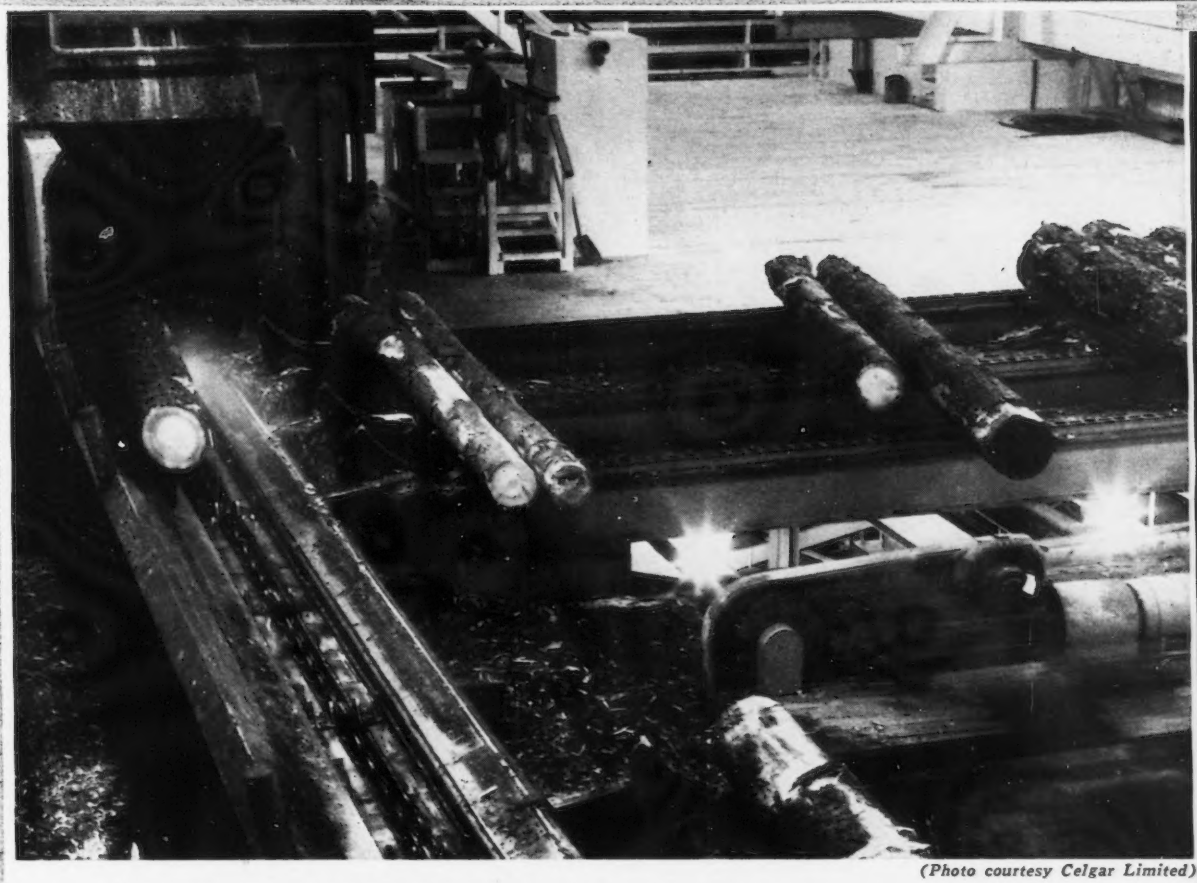
FOREST PRODUCTS JOURNAL

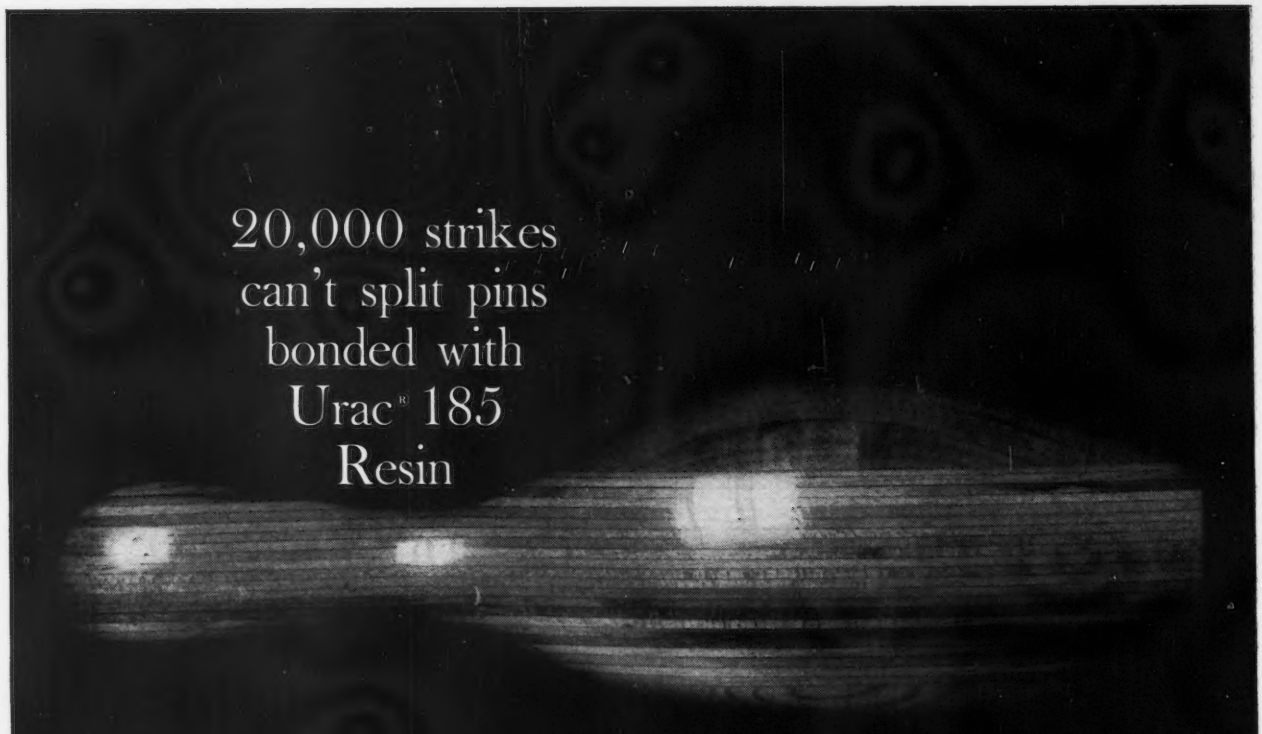
FOREST PRODUCTS RESEARCH SOCIETY



(Photo courtesy Celgar Limited)

A SPECIAL REPORT: The Industry's Research Programming for 1962

Vol. XI, No. 12 1961 / DECEMBER



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FOREST PRODUCTS JOURNAL

Vol. XI, No. 12 December, 1961

CONTENTS

Page

A Special Report: The Industry's Research Programming for 1962 545

Accelerated Weathering of Red Oak Treated With Various Preservatives Used to Treat Crossties .....*R. C. Rietz* 567

Wooden Pallets and Pallet Containers: Present and Future Markets .....*W. H. Sardo, Jr.* 576

Oregon Woods for Crossties .....*D. J. Miller* 579

Effect of Particle Geometry and Resin Spread on Glue-Line Thickness and Distribution in Oak Flakeboard .....*R. N. Jorgensen and W. K. Murphey* 582

The Interrelation of Government and Private Research .....*C. C. Heritage* 586

DEPARTMENTS

From the President's Desk 2-A

News Digest 3-A

New Products and Literature 10-A

Coming Events 9-A

Abstracting the Literature 590

1961 Forest Products Journal Index 593

Names in the News 15-A

Employment Opportunities 15-A

Reader Service Form 16-A

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The National Staff Wishes Each Reader A Merry Christmas And A Happy New Year

COVER PHOTO

In keeping with our special report on page 545, the cover photo shows a Hansel arm barker handling fir and pine logs at the new Celgar Limited sawmill. Highly automated, the new mill is the first fully integrated lumber and pulp operation in the interior of B. C.

. . . from the

President's Desk

ALL of us are conscious of the cost upheaval that has hit each of us in the past few years. The Forest Products Research Society is no exception. The ever-spiralling cost of operation of the Society—just as in your own affairs—has been a major problem. In addition to membership growth activities, the other question has been: how to cut here and here so as to continue and expand the Society services you want. This has required critical evaluation of every dollar spent by your Society—and every activity budgeted..

The Executive Board faced this question when it initiated increasing annual membership dues and subscription price from $15 to $20 a year ago. The increased income, however, has virtually been matched by the increased costs of materials and service.

To begin with, the increased dues and subscription price approved in 1960 first covered a loss which the Society was encountering. This was borne out late in 1960 by the institution of an improved bookkeeping and cost accounting system which realistically showed the Board the actual costs of operation of the Society. This directed your Board to a program to cut expenses everywhere it could. An example was the Board's approval of purchase of offset printing equipment which has led to 27 percent lower printing costs of reprints and other material printed by the National Office.

Yet, with such savings in hand, the Board was then confronted with a new increase in the printing costs of the *Journal*, and increases in paper and postage costs. In 1959, economy efforts had also reduced the editorial staff of the *Journal*. The Board recognized that the *Journal* editorial staff should be rebuilt and maintained on a sound basis. The direct costs of publishing the *Journal*, including editing salaries, engraving, printing paper, etc., increased from $39,650 in 1960 to more than $43,000 in 1961. In this same period, the total budget of the Society increased from $103,500 in 1960 to $106,452 in 1961. Income was $92,160 in 1960 and is estimated at $106,500 for this year.

The question arising before the Executive Board at the moment is the "out-of-pocket" costs of servicing approximately 400 student members of the Society. It is important to acquaint wood technology students with the program of FPRS, and to provide them monthly with copies of the *Journal* so that they can keep posted on the latest research developments in wood technology. Student dues have been $3 per year for many years, where the actual costs to provide this service have increased to $6 per year. This $6 cost is merely for membership processing, paper and postage costs of the monthly *Journal*, etc., with no apportioned costs for editing the *Journal*, printing, Society overhead, etc. A few years ago, the $3 a year would have more closely covered these costs. It no longer does.

Within the framework of financial reassessment, any provision for student membership fees that meet the $6 cost of serving each student member becomes only one step consistent with the entire "tightening up" program. Every discussion of the subject has stressed the value of student members to the Society, as well as the Society's responsibility for stimulating and encouraging students. So, the question before your Executive Board is: "Should we approve a dues increase for student members to where they pay actual "out-of-pocket" expenses to the Society for their membership?"

The Executive Board is considering action leading to a Constitutional amendment to increase student dues to cover actual expense. If passed at the Spokane meeting and by subsequent letter ballot, it would become effective in 1963. In response to a letter on this subject, several Sections have voted to cover the difference betwen cost and fee for students in their areas until an amendment, if passed, becomes effective.

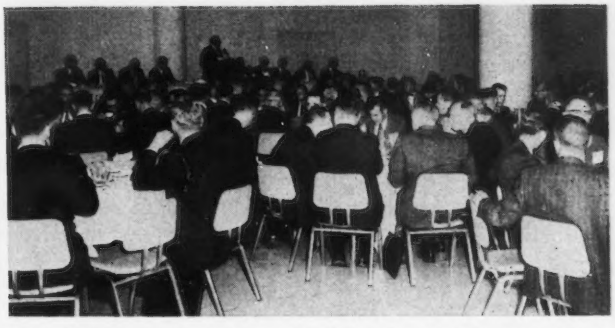
Some members of your Executive Board feel that the National Office should subsidize a portion of the student fee to encourage their future membership in the Society. Others feel that $6 a year dues for students is fair, and that economy of operations must be effected in every activity of the Society.

Thus, your Board is interested in the opinion of FPRS membership. This is your Society. Let your Section officers know how you feel about the student dues question. Or, write your views to me or to your National Office at Madison, Wisconsin, so that your Executive Board can have your comments and suggestions in hand while considering this matter.

—Donald K. Saunders

FPRS **News-Digest**

Midwest Composition Board Clinic Termed "Tremendous Success"



PARTICIPANTS in the morning session included J. C. Elf, W. C. Lewis, W. A. Gullicksen (standing), F. O. Marion, P. H. McCormack, C. M. Gray, and Richard Campbell (seated). Second photo shows the capacity crowd at the official luncheon.

"One of the most productive and most valuable meetings I've attended in years," was a typical comment that epitomized the general feeling of the 300 registrants at the FPRS Midwest Section's Wood Composition Board Clinic, October 19 and 20, in Chicago, Ill.

The 2-day session, which was run like clockwork by general chairman James C. Elf, product manager for particleboard and adhesives, National Starch and Chemical Corp., was marked by a dozen provocative presentations from figures on both sides of the coin—those that produce insulation boards, particleboards, flakeboards, shaving-type boards, and those that use these products in prefab houses, furniture, millwork, panels, cabinet work, and musical instruments.

Theme of the meeting—"Composition Boards, Today and Tomorrow," was set by Wayne C. Lewis, engineer,

Almost 300 Enthusiastic Members and Guests Attend 2-Day Session at Chicago's Fabulous McCormick Place

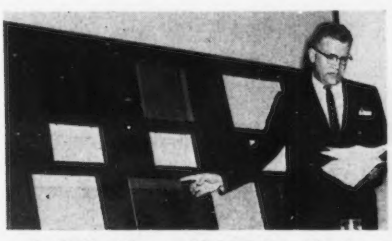
U. S. Forest Products Laboratory, Madison, Wis. Lewis was followed by a producer panel that included: C. M. Gray, manager of the Insulation Board Institute (who presented a paper on behalf of IBI technical director Robert LaCosse); F. O. Marion, vice president of sales, Masonite Corp.; Paul H. McCormack, products development engineer, National Starch & Chemical Corp., Plainfield, N. J.; and Richard Campbell, production manager, Southern Plaswood Corp., Hope, Ark.

The afternoon session included as members of a user panel: Andrew Place, president, Place & Co., South Bend, Ind.; Jack Halberg, wood technologist, Hamilton Mfg. Co., Two Rivers, Wis.; Arthur Pais, president, Laminite Plastics Corp., Chicago, Ill.; Vincent Washburn, works manager, Hammond Organ Co., Chicago; Ted Kindel, vice president, Kindel Furniture Co., Grand Rapids, Mich., and C. O. Hutchinson, manager, Industrial Paint Division, Glidden Co., Cleveland, Ohio.

Presentations in both sessions were noteworthy for their frankness in showing not only the progress that has been attained with the various wood composition boards but also the problems associated with their manufacture and use.

The success of these two sessions was attested to by the fact that the open forum Friday morning again drew a packed house. Moderator James Elf genially but forcefully insisted on audience participation—and

Ted Kindel, Vincent Washburn, and James Elf, listen attentively as Andrew Place presents the homebuilders vewpoint.



C. O. Hutchinson, Glidden Co., Cleveland, Ohio, described recent developments in finishing systems for composition board.

Luncheon speaker Harry C. Smith, Braun & Aldridge, Inc., urged the group to "get aboard the marketing troika."

MIDWEST SECTION OFFICERS: Front row, left to right, W. A. Gullicksen, Churchill Cabinet Co., Chicago, Ill., past chairman; Roy Newstedt, Wurlitzer Co., De Kalb, Ill., chairman; Ralph Simeon, J. J. Fitzpatrick Lumber Co., Skokie, Ill., treasurer; back row, Robert Archambeault, National Casein Co., Chicago, trustee; James C. Elf, National Starch and Chemical Corp., Chicago, secretary; Forrest Beil, Cardco Inc., Dubuque, Iowa, trustee; K. E. Kimball, U. S. Forest Products Laboratory, Madison, Wis., vice chairman; J. F. Koellisch, Wood & Wood Products Magazine, trustee; and Nels Glesne, Casswood Industries, Inc., Beardstown, Ill., trustee. Not pictured are trustees Charles Walters, University of Illinois, and George Wilhelm, Bacon Veneer Lumber Co., Chicago.

he got it. Not only the panel, but also members of the audience, were bombarded with questions on a myriad of problems—bleed-through of resins on face veneers; telegraphing; edge finishing; use of oak for particleboards; factory finishing; cure systems; properties of insulation board—to name a few.

Again, the 3-hour session was characterized by a frank and open interchange of information. As the session adjourned promptly at 12 noon, numerous appointments were made between members of the audience and the panel of experts to pursue individual problems.

The official luncheon speaker Thursday afternoon was Harry C. Smith, director of marketing, Braun & Aldridge, Inc., Orland Park, Ill., who challenged the wood industry to "get aboard the marketing troika," and called for the "three major divisions of business: production, finance, marketing to pull together in harness, without veto and move the profit sled."

At the annual meeting of the Midwest Section, Roy Newstedt, Wurlitzer Co., Dekalb, Ill., was elected chairman; K. E. Kimball, U. S. Forest Products Laboratory, Madison, Wis., vice chairman; James C. Elf, National Starch and Chemical Corp., secretary; and Ralph Simeon, J. J. Fitzpatrick Lumber Co., Skokie, Ill., treasurer. W. A. Gullicksen, Churchill Cabinet Co., Chicago, Ill., will remain on the Midwest Board as past chairman.

Pacific Northwest Holds Joint Meeting with ISA

Qualicum Beach, Vancouver Island was the scene of a joint meeting of the Pacific Northwest Section of FPRS and the Instrument Society of America. Held October 16 and 17, it was the first joint meeting of the two groups.

R. W. Wellwood, professor, Faculty of Forestry, University of British Columbia, and William Francis, research engineer, Simpson Company, Shelton, Washington, were co-chairmen of the FPRS sessions.

The morning session included presentation of the following papers: "The Economics of Lumber Sorting," by J. Charles Clapham, British Columbia Research Council, Vancouver, B. C.; "Efficiency of Resin Usage in Particleboard," by Murray Carroll, The Borden Chemical Co., Springfield, Oregon; "The Researcher and Sales: A Study in Coordinating New Product Development with Administration and Promotion," by H. W. Berry, Douglas Fir Plywood Association, Tacoma, Washington; and "Permeability of Douglas-fir in Western Washington," by H. D. Erickson and E. M. Estep, University of Washington, Seattle.

F. Arthur Jackson, Bristol Company of Canada Ltd., was chairman of the ISA session. The keynote address, "Instrumentation Accepts the Challenge," was presented by C. W. Covey, editor, ISA Journal. Other presentations included: "The Operation and Instrumentation of a Pipe-Type Kiln," by M. Salaman, Canadian Department of Forestry; "Automation and Instrumentation in Forest Products Industries," by Sherman Bird, Republic Electric and Development of Seattle; and "High Speed Veneer Gauging for the Plywood Industry," by J. E. Sperry and Alex McCallum, Brush Engineering.

A panel discussion on instrumentation and control of drying, moisture measurement, automatic sawmill equipment, and plywood and particleboard equipment was held in the afternoon.

A social hour and banquet were held in the evening at the Qualicum Inn. FPRS President Elect, T. S. Veazey, Anaconda Co., Bonner Montana, and Mr. Covey of ISA were guest speakers.

On Tuesday, October 17, field trips were made to the Comox Logging Company's operations at Courtenay and the Elk Falls sawmill and pulp mills at Campbell River.

FPRS Annual Meeting

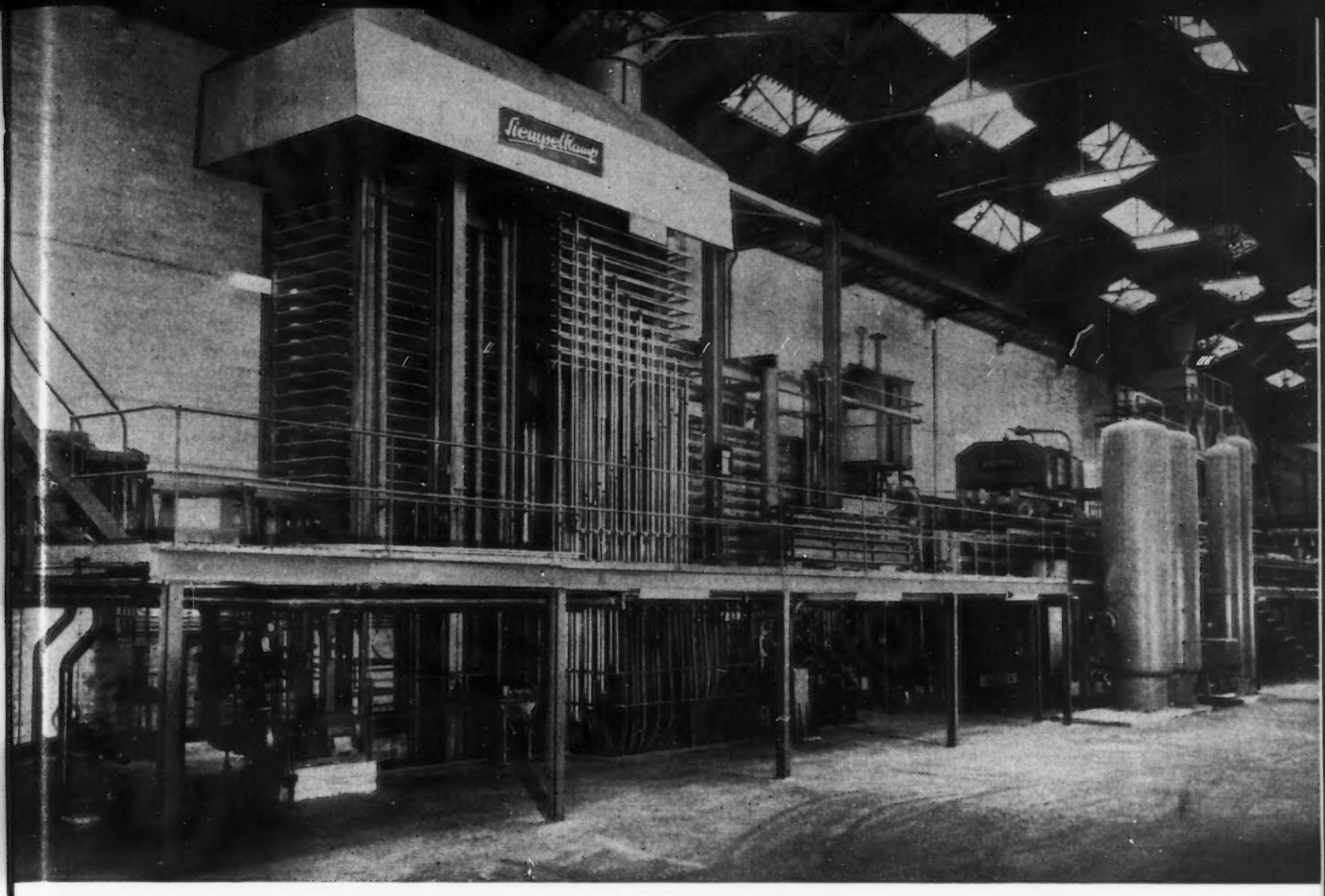
June 17–21, 1962

Spokane, Washington

N. Calif. Section Discusses Utilization of Young Timber

The Northern California Section of the Forest Products Research Society had its annual Fall Meeting October 20 in Fort Bragg, Calif. A technical session was presented concerning young timber utilization and included Drs. Diana Smith and Robert Youngs, U. S. Forest Products Laboratory, Madison, Wis.; Robert Grundman, Union Lumber Co., Fort Bragg, Calif.; William Smith, J. H. Baxter & Co., Willits, Calif.; and Dr. Herbert McKean, Potlatch Forests, Inc., Lewiston, Idaho. The session was under the direction of Dr. Eric L. Ellwood, program chairman.

Attendants were welcomed at luncheon by Victor Roth, Chairman of the Section, and heard H. Pierson Plummer speak on "California Redwood—A Study in Unique Problems in Production and Merchandising." The meeting concluded with a plant tour of the Union Lumber Company, Fort Bragg. Officers for the Northern California Section are: Victor S. Roth, chairman; Eric L. Ellwood, vice chairman and program chairman; and William A. Dost, secretary-treasurer. Alan Goudy and Harvey H. Smith are trustees, and MacGregor Graham is the regional board member. Rodrick E. Black was the local arrangements chairman.



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SECTION CHAIRMAN John W. Squires was host to FPRS President Donald K. Saunders during the Forestry and Forest Products Parade held in Jackson, Miss., during the Mid-South Meeting.

Mid-South Co-Sponsors Wood Exposition, Elects New Officers at Annual Meeting

"Too Many Trees?" was the theme of the annual meeting, Mid-South Section, held in the King Edward Hotel, Jackson, Mississippi, October 12, 1961. In this theme the *question mark* is important, calling attention to the practical significance of the shifting balance between growth and drain in southern forests. For the first time in the series of southern forest surveys, the records are beginning to show that we are growing wood faster than we are using it, at least in some species in some places. Underlying the bare fact, however, is a complex pattern of conflicting land-use demands, scarcity of wood in many of the traditionally valuable sizes, species and grades, fierce competition from other materials, and a host of new wood products and manufacturing processes.

John W. Squires, Chairman of the Mid-South Section, presided at the all-day session, where the theme subject was developed by three well known experts. Philip R. Wheeler, Chief of the Division of Forest Economics, Southern Forest Experiment Station, discussed the changing inventory of forest resources in a paper entitled "How Many Trees Do We Have?" Utilization problems for pine and for hardwoods were discussed by John O. Batson, General Manager, Scotch Lumber Company, Fulton, Alabama, who spoke on "Southern Pine—Our Challenge," and H. S. Mersereau, General Manager of the Crossett Lumber Company, Crossett, Arkansas, whose subject was "The Future of Hardwood Utilization."

Highlighting the "New Look" in wood utilization the first annual Southern Wood Exposition was held in the King Edward Hotel for three days concurrently with the FPRS meeting, sponsored jointly by the Mid-South Section and James Van Horn, owner and manager of *Dixie Lumberman and Forester* magazine of Jackson, Mississippi. In addition to exhibits by manufacturers and distributors, a key feature of the exposition was a display of entries in the "New Wood Products Contest," in which new and useful articles made from wood were awarded prizes based on originality, craftsmanship, and promise for industrial application.

At the annual business meeting, DeVere Dierks, Jr., of Hot Springs, Arkansas, was elected Chairman of the Mid-South Section for the ensuing year. Dr. Warren S. Thompson, Louisiana State University School of Forestry, was elected Vice-Chairman, and George Rosentreter, Crossett Company, Crossett, Arkansas, was elected Secretary-Treasurer. Arthur D. Syska was elected Trustee from Arkansas to fill out the unexpired term of Dave Fisher, who has moved out of the section's territory. Edwin Y. Wheeler was re-elected Trustee from Oklahoma for a second two-year term. New trustees elected from Louisiana and Texas respectively are W. N. Darwin and Paul Kramer. The terms of the present trustees from the other Mid-South Section states, Mississippi and Tennessee, continue for another year.

Wisconsin Plans Adhesives Institute, January 16–17

The University of Wisconsin will hold a 2-day institute on industrial adhesives applications January 16–17 in the Wisconsin Center Building, Madison, Wis.

Main objective of the institute is to review some of the basic principles and fundamentals involved in adhesive usage. Subjects covered will be principles of bonding, design of joints, glued wood products, adhesives in construction, structural adhesives for metals and plastics, packaging, equipment requirements, and principles of adhesive formulation.

Registration fee is $25. For additional information contact: William W. Wuerger, Institute Coordinator, Engineering Department, University Extension Division, University of Wisconsin, Madison, Wis.

E. Sigurd Johnson Killed Nov. 3 In Plane Accident

The National Office regrets to report that E. Sigurd Johnson was killed in an aircraft accident near Asheville, North Carolina, November 3, 1961.

Professor Johnson was flying his own Cessna 180 airplane enroute from the FPRS Carolinas–Chesapeake Section meeting in Asheville to Charlotte when the tragedy occurred.

The body and the wreckage of the plane were found November 9 in the rugged Saluda Mountains near the South Carolina line after a five-day search by the Civil Air Patrol, Army and Air Force personnel, and several members of FPRS.

Professor Johnson was head of the furniture manufacturing and management section of the North Carolina State College of Engineering at Raleigh. He was also president of Production Development Co., Inc. of Raleigh.

A charter member of the Forest Products Research Society, Professor Johnson was active on committees and a frequent contributor to the Forest Products Journal and to the Society's annual meetings.

He is survived by his wife, Alice H. Johnson, and four children.

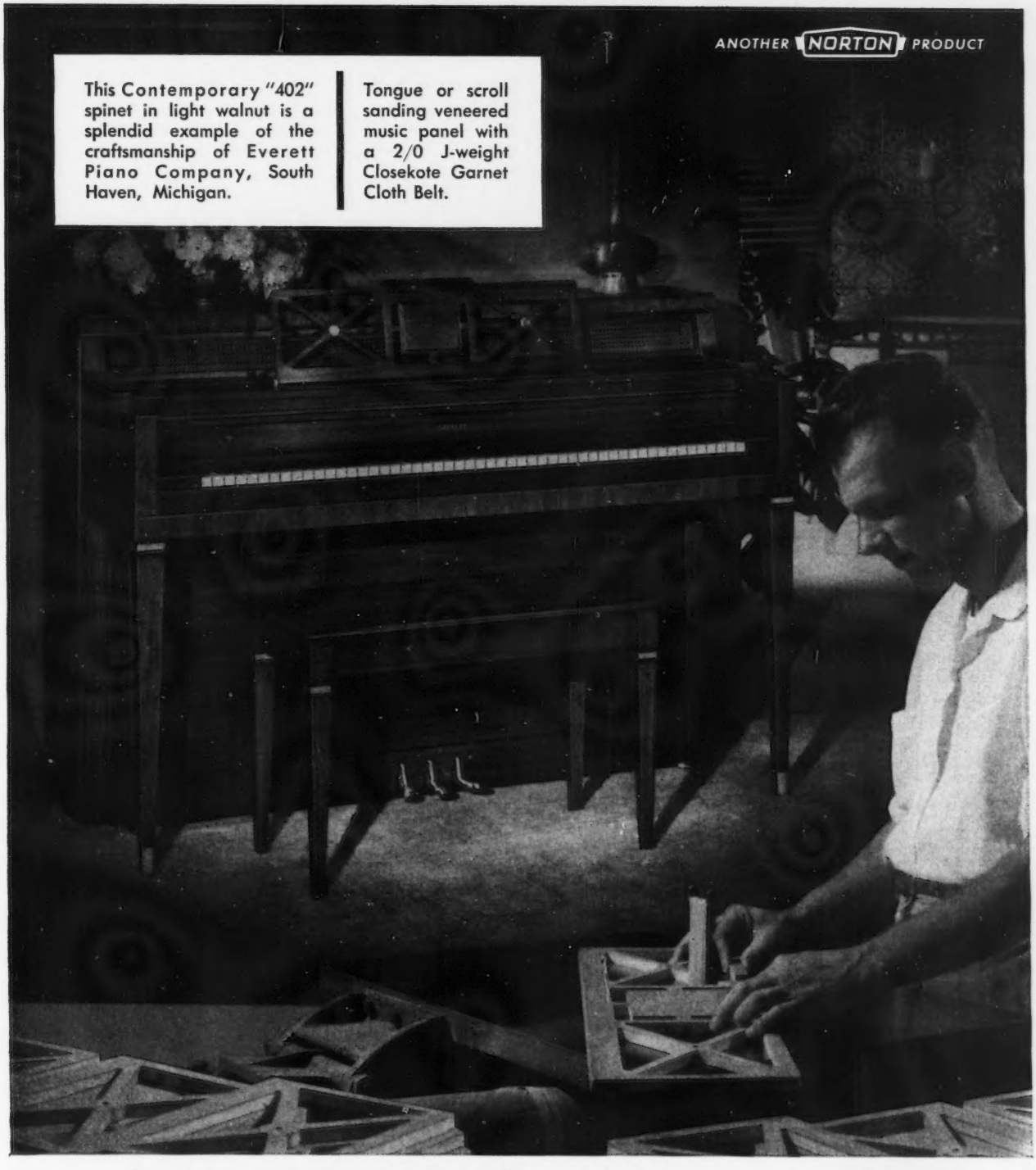
In memoriam, an E. Sigurd Johnson Scholarship fund to aid students in the furniture curriculum at N. C. State has been set up. Contributions may be sent to: Dean J. H. Lampe, School of Engineering, North Carolina State College.

World Forestry Information

Proceedings of the Fifth World Forestry Congress, the most comprehensive compilation of world forestry knowledge in existence, are now being published, Dr. V. L. Harper, Chairman of the Executive Committee of the Congress, has announced.

All three volumes may be purchased for $25, the cost price, through advance orders only, placed prior to January printing with delivery later in 1962. Other information may be obtained from Dr. V. L. Harper, Chairman of the Executive Committee, Fifth World Forestry Congress, % Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

PARTNERS IN PROGRESS AND LEADERSHIP . . .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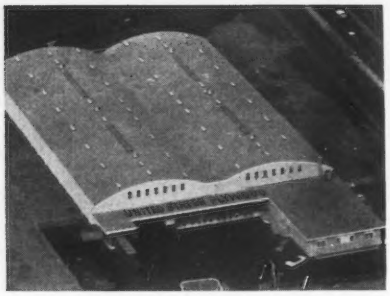

U. S. Plywood Opens New Branch

The curtain went up on United States Plywood Corporation's new 70,000-square foot Philadelphia sales center and warehouse with an official opening for the public at Aramingo Avenue and Wheatsheaf Lane.

"Our new showroom and warehouse are among the most modern of the company's 145 sales outlets throughout this country and Canada," points out branch manager J. T. Arens. "This large warehouse, with its 4,000-square foot loading platform, can accommodate as many as 16 trucks and three railway freight cars simultaneously."

He says this makes for a 25 percent space increase over former Philadelphia quarters. The building's modern exterior is of buff brick and blue Glasweld. Glasweld, a U. S. Plywood exclusive, is a permanently colored, all-mineral panel.

Architecturally matched walnut decorates the 500-square foot branch manager's office, which doubles as a conference room. It's 10-foot high walls and huge doors are of Permagard, the firm's new line that is surfaced with a clear, thermosplastic.

Total office area in the building is 6,000-square feet. The walls, paneled with a variety of species, were designed by Betty Jennings, the company's staff designer of New York. A separate 700-square foot display room also doubles as a meeting room and is paneled in Weldwood teak and Honey Korina. It features concealed "pocket" displays as well as an area for removable panels. This way architects can simulate an entire wall of paneling in place.

Pallet Association's 15th Semi-Annual Meeting

The 15th Semi-Annual Meeting of the National Wooden Pallet Manufacturers Association will be held in Hollywood, Florida, at the Diplomat Hotel from February 4, 1962 through February 7, 1962. Between 125 and 150 persons from the United States and Canada are expected to attend this important industry meeting.

The Semi-Annual Meeting will consider plans for expansion of present wooden pallet and pallet container markets, will review the progress of NWPMA's Trade Promotion Program, and will approve the 1962 promotion plans for the Association.

Non-members of NWPMA, who are connected with wooden pallet manufacturing and distribution, will be welcome at the meeting, but must secure invitations for attendance in advance of the meeting dates by writing to the National Wooden Pallet Manufacturers Association, 1619 Massachusetts Avenue, N. W., Washington 6, D. C.

BRI Becomes Independent Technical Society

The National Academy of Sciences, National Research Council announced today that the Building Research Institute, a constituent part of the Division of Engineering and Industrial Research, will—late next year—become an independent technical society for the building sciences.

In making the announcement, Dr. Detlev W. Bronk, president of the Academy-Research Council, said, "The Buckley report, which recommended in 1951 the establishment of the Building Research Institute within the Academy, Research Council, recommended also that the Institute be encouraged to work toward independent status. It is truly gratifying that within the span of a decade the Institute has established itself as a uniquely effective instrument for the stimulation and correlation of interdisciplinary research in the building industry, whose extraordinarily diverse interests otherwise depend upon the attention of nearly 500 separate associations in the field.

In an accompanying statement, Leon Chatelain, Jr., President of the Building Research Institute, said that the change of status will ". . . make no changes in the organization except to encourage BRI to further broaden its activities in the stimulation of needed new building research, to administer cooperatively sponsored research projects, and to accept grants for the execution of valuable projects consistent with its purposes.

"The regular member services will also be continued in their present form," he said, "including the monthly Building Science News, the Building Science Directory, and the developing BRI Documentation Service. The expansion of the Institute's technical activities will also make possible the extension of the present Monograph Series of publications, and provide for wider distribution of important documents not produced through conferences and workshops."

"Where To Buy"

The Hardwood Plywood Institute has prepared a new edition of a directory that is being made available at no charge to every purchaser and specifier of hardwood plywood in the United States and Canada. The booklet, "Where to Buy," includes the name and address and phone number of every member of the Institute with information as to their annual capacity in square feet based on one-shift production surface measure, the size of plywood they prefer to manufacture and the maximum size produced.

The types of glue bond used in manufacturing the plywood are given whether its Type 1 (fully waterproof), Type II (water-resistant), or Type III (moisture-resistant), as well as the actual name of the glue used. The types and quantity of equipment are also listed.

Mr. Bob Weber, President of the Hardwood Plywood Institute, stated that copies of "Where to Buy" are being furnished to the interested trade associations for distribution to their entire membership. The directory is offered free to purchasers, consumers, and specifiers of hardwood plywood.

U. S., Canadian Foresters Meet

Professional foresters in the United States should concern themselves more with the social and political implication of their activities, urged Harry S. Mosebrook, Manager of Public Affairs, Eastern Region of the Weyerhaeuser Company.

In a keynote address to the joint international meeting of the Society of American Foresters and the Canadian Institute of Forestry, Mr. Mosebrook pointed to national issues he felt would shape the future course of professional foresters in the U. S. The need to 1) assure sound forestry technical assistance programs in extending our knowledge to other countries, 2) create a better understanding of the principle of multiple use among the people of this nation, 3) obtain necessary information before entering on broad programs of public assistance to owners of small woodlands, and 4) restrict the movement of forestry in the direction of increased Federal domination and control, were noted specifically as issues of importance.

More than 1,000 members of the national professional societies attended the meeting. New developments in the management of forest land for timber, water, recreation, wildlife, and forage were discussed by more than 60 speakers at these sessions.

Diehl Modernizes Name

Wallace E. Carroll, Chicago, president of the American Gage & Machine group, today announced a new name for the 52-year-old AG&M woodworking machine affiliate, The G. M. Diehl Machine Works, Inc., Wabash, Indiana. The new streamlined title will be *Diehl Machines, Inc.*, more directly suggesting the continuing development of new tools and special production machinery which characterizes current Diehl emphasis. The company is on the eve of introducing dramatic additional products for the woodworking industry, both through development and acquisition, according to Charles W. Tuttle, president.

DFPA Fallout Shelters Commended by CD Chief

The Douglas Fir Plywood Association has received a letter of commendation from the Department of Defense for its 2-year research project in low-cost family fallout shelters. The association recently announced the availability of plans for three basic versions of its shelter, to be built underground, above ground, and in existing basements.

The commendation came from Steuart L. Pittman, Assistant Secretary of Defense for Civil Defense. In a letter to DFPA Executive Vice President W. E. Difford, Pittman wrote that the association "is to be commended for its outstanding efforts, which we are certain will help in a significant way to emphasize and accelerate the fallout shelter program that is such a vital part of civil defense."

Pittman also expressed appreciation for what he termed "the opportunity to assist you in the development" of fallout shelters his office described as "equal or superior to any designs presently available."

The association's shelters are made of easily available plywood and lumber in standard sizes. The underground version is made of pressure-treated material.

In answer to questions about the durability of this type of construction, R. M. Lindgren, chief of the division of wood preservation for the Forest Products Laboratory of the Department of Agriculture, wrote to the association that:

"A shelter of this type . . . . should remain serviceable . . . . for periods exceeding 20 to 25 years." His opinion was based on tests under the most hostile conditions to durability. In states outside the humid South, the life of treated wood is almost indefinite.

COMING EVENTS

Dec. 6–7: Annual Meeting FPRS Southeastern Section, Mobile, Ala.

★

Dec. 7: National Institute of Wood Kitchen Cabinets, Annual Winter Meeting, Sheraton Towers, Chicago, Ill.

★

Dec. 12–13: National Oak Flooring Manufacturers Assoc., Annual Meeting, Peabody Hotel, Memphis, Tenn.

★

Dec. 26–31: American Association for the Advancement of Science, Annual Meeting, Denver, Colorado.

★

Jan. 8–17: International Home Furnishings Market, American Furniture Mart and Merchandise Mart, Chicago, Ill.

★

Jan. 17–19: Appalachian Hardwood Manufacturers, Inc., Annual Meeting, Netherland Hilton Hotel, Cincinnati, Ohio.

★

February 21–24: National Wooden Box Association, 63rd Annual Meeting, Boca Raton Hotel, Boca Raton, Fla.

★

Feb. 28–March 3: Western Pine Association, Annual Meeting, St. Francis Hotel, San Francisco, Calif.

★

May 7–9: National American Wholesale Lumber Association, Annual Meeting, Edgewater Beach Hotel, Chicago, Ill.

★

June 17–21: Forest Products Research Society, 16th Annual Meeting, Davenport Hotel, Spokane, Wash.

If it's a question about wood preservatives...

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PENTACHOROPHENOL
Recognized as the leading preservative for protecting wood against decay and rot, termites and other wood-boring insects. Clean . . . won't stain . . . contains 5% Pentachlorophenol in a solvent base.

PRESSTREAT
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NOXTANE
Controls ugly blue-black sap stains and mold. Keeps lumber bright and clear . . . stops costly degrading. Contains no arsenic or mercury—non-irritating and dustless—resists leaching from rain.

WOODTREAT A
A 10% Penta emulsion paste. Gives maximum protection to standing poles, piling, cutoffs, structural timbers. Applied by hand scoop, brush, paddle or mechanical spray. Clean to handle . . . not highly toxic.

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For more information, write or phone . . .
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WOOD TREATING

NEW OR TRANSFER MEMBERS IN SEPTEMBER

Section Officers please note. Each month we will publish the new or transferred-into-the Section members for the previous complete month. New members are listed in boldface type, transfers in regular type. Letters in parentheses after the members name indicate: (A), associate; (V), voting; (s), student; and (S), supporting.

CAROLINAS–CHESAPEAKE

G. L. Price (s), 416 Beverly Ave., Morgantown, W. Va.

D. L. Thore (s), 2144 Mayview Rd., Raleigh, N. C.

V. S. Delan, Jr. (V), 644 Charles St., Ave., Towson 4, Md.

Sirfraz Ahmed Khan (A), c/o R. C. Fulcher, FTD FAS, U. S. Dept. of Agriculture, Washington 25, D. C.

R. B. Lowrey (s), Box 1151, Duke University, Durham, N. C.

GREAT LAKES

R. A. Gerner (V), R. A. Gerner Lumber & Wood Prod., Box 417, Canfield, Ohio

G. H. Gramelspacher (V), Jasper Wood Products Co., 13th & Vine, Box 271, Jasper, Ind.

J. E. Shottafer (V), Brunswick Corp., 525 W. Laketon Ave., Muskegon 82, Mich.

R. J. Ward (s), Dept. Chem. Eng., Case Institute of Tech., University Circle, Cleveland 6, Ohio

Dewayne Weldon (s), 111–I Univ. Village Michigan State Univ., East Lansing, Mich.

INLAND EMPIRE

M. D. Conner (s), 608 California St., Pullman, Wash.

W. C. Forrer (s), 515 East Pine, Missoula, Mont.

Laurent Taylor (s), Farm House Fraternity, Univ. of Idaho, Moscow, Idaho

N. T. Shelton (V), Potlatch Forests, Inc., 202 Garden City Apts., Lewiston, Idaho

A. C. Tondolph (S), 2531 Smith St., Boise, Idaho

MID-SOUTH

E. G. Burnett (V), Burnett Lumber Co., Box A, Heavener, Okla.

O. L. Fitzgerald (V), Louisiana Polytechnic Institute, Box 507, Tech. Station, Ruston, La.

C. H. Lewis, Jr. (V), Louisiana Forestry Assn., Box 789, 1104 Sixth St., Alexandria, La.

MIDWEST

A. E. Harrington (V), Bradley University, Duryea Hall, Peoria, Ill.

Michael Hittmeier (s), 2108 Prairie Ave., Mattoon, Ill.

R. J. Kolp (V), U. S. Plywood Corp., 3805 N. Carnation Ave., Franklin Park, Ill.

R. H. McAlister (V), U. S. Forest Products Lab., Madison, Wis.

G. F. Wilhelm (V), R. S. Bacon Veneer Co., 4702 W. Augusta Blvd., Chicago 51, Ill.

W. W. Alcorn (s), 435 Signal Hill Rd., Barrington, Ill.

G. H. Englerth (V), U. S. Forest Products Lab., Madison, Wis.

Charles Gatchell (V), 402 Palamino Lane, Madison, Wis.

NORTHEAST

Robert Bird (V), Norwich University, Northfield, Vt.

R. A. Hale (V), 219 Main St., Lisbon Falls, Me.

B. D. Halpern (V), Borden Chemical Co., Box 9524, Godfrey & Langdon, Philadelphia 24, Pa.

C. A. McMurray, Jr. (A), c/o Shell Chemical Co., Ind. Chem. Div., 110 W. 51st St., New York 20, N. Y.

National Starch & Chemical Corp (S), Attn.: H. J. Zahrndt, 1700 W. Front St., Plainfield, N. J.

W. G. Owens (V), Armstrong Cork Co., 2500 Columbia Ave., Lancaster, Pa.

J. H. Thoden, Jr. (V), National Lbr. Mfg. Assn., 69 Finucane Rd., Rochester 23, N. Y.

F. R. Valentine (V), Homasote Co., Box 441, Trenton 3, N. J.

Lt. D. V. Vanek, (A) B-Btry, 2nd RKT How BN, 16th Arty., APO 326, New York, N. Y.

R. J. LaBar, (V) 136 S. First St., Bangor, Pa.

(Miss) Su-Ching Lai, (A) 704 Comstock Ave., Syracuse 10, N. Y.

R. L. Odell, (s) c/o Schimmel, Box 88, Nanticoke, Pa.

OHIO VALLEY

S. S. Sakornbut, (V) 955 Kimberly Dr., Kettering 29, Ohio

PACIFIC NORTHWEST

E. H. Collins, (V) Mt. Pit Co., Box 1309, Medford, Ore.

R. W. Meyer, (s) 7010—17th Ave., N. E., Seattle 15, Wash.

Len Moyer, (V) Vancouver Plywood Co., Vancouver, Wash.

K. M. Macdonald, (V) 2857 Evergreen Pt. Rd., Bellevue, Wash.

PACIFIC SOUTHWEST

J. W. Gehring, Jr., (V) 1040 Cliff Dr., Santa Barbara, Calif.

ROCKY MOUNTAIN

A. E. Kent, (s) 333 Ellis Hall, Fort Collins, Colo.

T. E. Norman, (s) 315 W. Lake, Fort Collins, Colo.

SOUTHEASTERN

Terry Sellers, Jr., (s) 101 Beech St., Apt. 12, Auburn, Ala.

L. C. Walker, (V) School of Forestry, University of Georgia, Athens, Ga.

R. A. Jiles, Jr., (V) U. S. Forest Service, 50 Seventh St., Atlanta, Ga.

UPPER MISSISSIPPI VALLEY

R. G. Head, (V) Weyerhaeuser Co., Rilco Div., Box 571, Albert Lea, Minn.

J. W. Steward, (V) Box 629, Rochester, Minn.

Leighton Walstrom, (V) 4630 Washington St., N. E., Minneapolis 21, Minn.

FPRS SECTION MEMBERSHIP GOALS

Wanted: 331 New Members by June 1, 1962

Section	New V. & A. Members Section Goal	Percent of Goal Attained	Goal for New Supporting Members	Percent of Goal Attained
Midwest	30	30	3	0
Ohio Valley	10	40	2	0
Great Lakes	20	25	1	0
Upper Mississippi Valley	10	20	1	100
Mid-South	25	48	3	33
Northeast	45	28	5	20
Eastern Canadian	20	20	2	0
Carolinas–Chesapeake	30	10	3	0
Southeastern	10	20	1	0
Pacific Northwest	50	10	5	60
Inland Empire	10	10	1	0
Northern California	20	5	2	0
Rocky Mountain	10	0	1	0
Pacific Southwest	10	20	1	0
Total	300	21	31	19

NEW PRODUCTS *and Literature*

Tractor Hitch

The International Harvester Company has approved the new automatic Insta-Hitch system for their tractors. This was announced by Powell Pressed Steel Company, Hubbard, Ohio, manufacturers of the new hitching system.

The sales representatives at Powell Pressed Steel are putting on demonstrations around the country and soon the International Harvester dealers will be putting on the same demonstrations for their local customers.

Safety is a main feature with the Insta-Hitch System. There's no heavy lifting on the part of the workman, no chance of hand-mashing because he stays in the tractor seat where he can't get hurt.

The design principal of Insta-Hitch is two triangular frames, one nesting inside the other. The outer frame (female) is attached to the various equipments to be used, the inner frame (male) is attached to the tractor. A guide hook is positioned at the apex of the triangle of the inner frame making the primary engagement for the two frame surfaces. The triangular shape assures positive alignment, leveling and positioning.

Insta-Hitch Systems are being distributed nationally through the International Harvester Dealers. Inventories are now being received by the dealers for application to all International Harvester tractors as well as all other equipment, attachments and all other three-point tractors. Write for more information.

Circle Item 1

New Redwood Bark Product

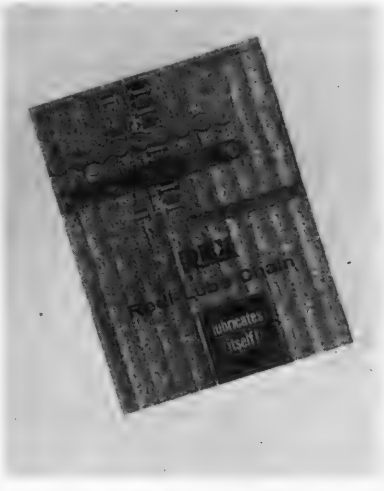
The Pacific Lumber Company has announced plans to market a totally new redwood bark product for use in playgrounds and recreation areas and parks. The product is specially processed redwood bark, which achieves an unusually permanent, resilient and shock resistant ground cover requiring minimum maintenance.

Initial applications of the new redwood bark product in playground and recreation areas in San Francisco and Oakland have resulted in encouraging prospects for broad use of the material as a soft, springy, shock absorbing ground cover under apparatus, on walkways and in play areas. When used in play and traffic areas, redwood bark does not kick around like granular barks. Because its fibrous texture forms an almost continuous mat, it does not blow away—a problem common where sand is used.

Other features of The Pacific Lumber Company's new redwood bark are its inherent ruggedness and durability. The bark does not become water logged and soggy in rainstorms, it dries quickly when wet, and is impervious to rot and decay. Because of its natural resiliency and fibrous characteristics, redwood bark will not become compacted and lose its spring and softness. It does not leach out and will not stain hands or clothing. It is odorless when wet or dry.

The redwood bark is available commercially in tightly compressed bales weighing approximately 105 pounds. At at 4-inch thickness, coverage per bale is approximately 48 square feet. Write for more information.

Circle Item 2

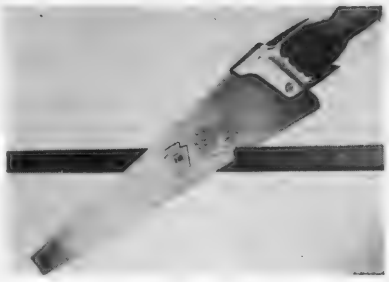


New Redi-Lube Chain

Production of new Rex Redi-Lube Roller Chain—a self-lubricating chain—has been announced by the roller chain division of Chain Belt Company. A new bulletin, no. 6117, covering the product is also available.

The new chain was designed especially for drives and conveyors that cannot be lubricated regularly. It provides protection against tough service conditions such as dust, dirt or moisture and is ideal for open and exposed drives. It can be used wherever the strength, wear life, and quiet precision operation of roller chain is needed. Write for more information.

Circle Item 3

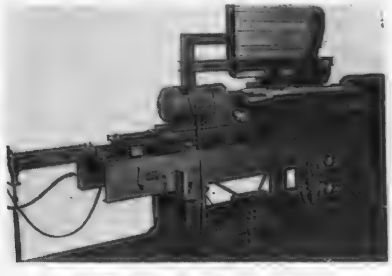


Hand Saw

A new top-quality hand saw, designed especially for the journeyman carpenter and woodworker, is now being manufactured and marketed by the Disston Division, H. K. Porter Company, Inc. Designated as the Disston D-100, "world's finest hand saw," it was introduced to the trade at the National Hardware Show in Chicago. One of the striking and utilitarian features of the D-100 is its solid walnut inlaid grip set in a sturdy aluminum frame. The grip is designed to provide the maximum in comfort and control.

The blade of the D-100 is made from Disston's finest quality, exclusive thick backed steel. Each tooth edge is precision ground to exactly the same gauge. Write for more details.

Circle Item 4



Double-End Boring or Chucking Machine

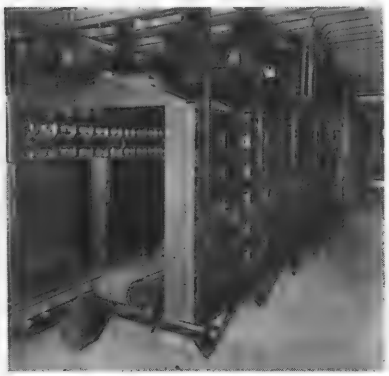
A new machine that can be used for either chucking or boring, or a combination of both, has been introduced by Union Tool Corporation, Warsaw, Indiana.

Known as the Indiana Type 5CBM, the new machine features a magazine feed which minimizes stock handling and increases production. The automatic feed adds a safety factor since operator's hands are never near the work units. The Type 5CBM machine is designed for efficient, versatile performance throughout the woodworking industry, and has proved ideal for a wide variety of applications. The standard magazine feed will accommodate stock up to 2 inches thick by 5 inches wide, 72 inches long. Round stock up to 2-inch diameter may also be run. More complete information may be obtained.

Circle Item 5

Infrared Oven Conveys Case Goods Without Using Pallets

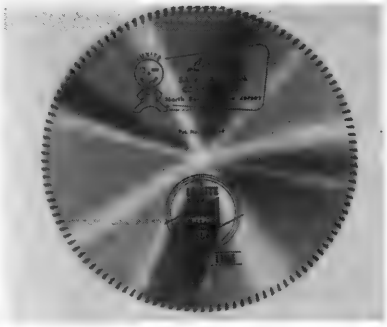
Wenco Furniture, Inc., of Wendell, North Carolina, recently completed the installation of a dri-Quik ceramic type electric infrared radiant oven which has been designed to handle the drying of furniture case goods. The conveyor and oven portion of the new finishing line are unique in that all case goods travel along the conveyor without using pallets. Instead, each case is mounted on skids as a base for level movement on the conveyor. This is one of the first systems of this type to be installed in the furniture industry.



The finishes being applied consist of two stain coats, one sealer coat and one catalyzed varnish top coat. The final catalyzed varnish top coat is all that is being handled by the driQuik infrared radiant oven. After the final varnish coat has been applied, the cases are power conveyed through an 8-minute flash-off oven, after which they pass through a 3-minute baking area in the dri-Quik oven. Upon leaving the radiant oven, high velocity air force cools the cases to room temperature, which requires approximately 1 minute, after which the case is cartoned immediately for shipment.

One of the economical features of this particular type of oven installation is that the exhaust air taken out of the radiant oven is then forced through a warm air, enclosed flash-off tunnel and later exhausted from the entrance end of the flash-off tunnel to the outside of the plant. This eliminates any other methods of heating which would normally be required for the flash-off tunnel. This driQuik oven has no infrared bulbs, quartz tubes, rods or sockets to burn out. Consequently, maintenance costs are at a minimum. Write for more information.

Circle Item 6



New Carbide Saw Tips

The Luxite Saw and Tool Corporation of North Bergen, New Jersey, has announced a newly designed and patented carbide tip, to be used for cutting nonferrous metals, plastics and woods.

This new wedge shaped tooth is brazed into the body of the saw blade giving greater tooth strength (keeps interference from developing at the base of the tip), constant smooth chip-free cutting, and longer life. It also permits the manufacture of a blade with a finer tooth pitch, than heretofore possible. Write for more information.

Circle Item 7

Power Transmission Belting

Power transmission belting used on industrial machinery today can generate more than 100,000 volts of potentially explosive static electricity, research by Extremultus, Inc., has revealed. In addition, test by the Englewood, N. J., company show that static electricity as low as 1,200 volts can set off disastrous fires and explosions.

Extremultus, one of the nation's leading suppliers of power transmission belting, has completed almost 5 years of extensive research into the problems of using belting in explosive and combustible atmospheres. As a result, it has developed a special "Non-el-Stat" belting for use in potentially hazardous locations.

Applications of Extremultus "Non-el-Stat" belting range from chemical installations having highly explosive gases to food processing plants whose atmospheres are filled with dangerously combustible dusts created by powdered sugar or flour. Although gas-air mixtures are generally considered more dangerous, dust-air mixtures can actually be set off at lower voltages. While most persons take great precautions when working with combustible or explosive fumes or gases, they do not consider dust as great a hazard and therefore are more liable to accidents.

Write for your complete information bulletin on the safe use of power transmission belting in combustible or explosive atmospheres, and information on how to arrange for an in-plant test of your own belting.

Circle Item 8

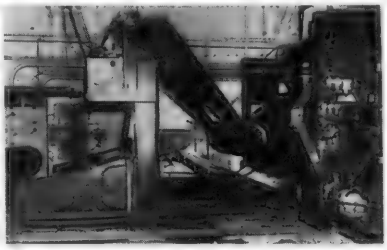
Speedlogger

Saw logs, pulpwood timber, and salvage wood can be handled more quickly and economically with the HIAB 176 Speedlogger, available through Stanco Mfgs. & Sales, Inc., Santa Monica, Calif., U. S. distributors of the Swedish-built hydraulic loader.

The HIAB 176 mounts directly behind the cab of any truck or tractor and takes only 15-inches of bed space. When not in use, it is carried over the load or over the cab, thus affording bigger payloads. One-man operated and fully hydraulic, the HIAB 176 Speedlogger snakes, swings and lifts loads up to 6,000 pounds in one continuous operation, affording extra loads at less cost daily.

Because of the portability of this truck-mounted crane, clean-up work can be handled faster—in many cases eliminating the need for skidding logs to general loading sites. Depending on ground conditions, the 176 can pick up logs at the stumps or skid them the shortest way to the nearest road. More details may be obtained.

Circle Item 9



Lathe Charger

A fully automatic, pre-centering lathe charger that eliminates operator error is now available to the plywood industry from the Nicholson Manufacturing Company. The new development is the Nicholson 601 Lathe Charger that gives fast, accurate centering for all types and sizes of veneer lathes. The log moves by a traveling carriage into the lathe and is controlled by the lathe operator. The much-needed machine saves manpower and greatly increases veneer recovery as logs are automatically centered eliminating operator error.

An installation of this new charger may be seen at the Medford Corporation, of Medford, Oregon, feeding an 8-foot lathe. Further information may be obtained.

Circle Item 10

Lady Chemist for USFPL

"I wanted to devote more time to research." That's the reason Dr. Margaret Seikel gives for leaving the job as chairman of the chemistry department at Wellesley College to become one of the few women in the world who are studying lignin structure determination.

Dr. Seikel, who has taught college chemistry for 21 years, recently accepted a position as an organic chemist at the U. S. Forest Products Laboratory, Madison, Wis., maintained by the Forest Service, U. S. Department of Agriculture. The Laboratory is currently conducting investigations to determine the basic structure, composition, and chemical characteristics of lignin, which is nature's cement for holding the cell walls of wood together. Lignin, which chemically makes up approximately one-third of wood, at present has no major industrial use. Dr. Seikel will be the associate of John C. Pew, who is the head of the lignin research at the laboratory.

A recipient of several grants, including two from the National Science Foundation for her work on flavonoids, Dr. Seikel has published over 20 articles in various chemical journals. She is a graduate of Mount Holyoke College and a member of Phi Beta Kappa. After obtaining a master's degree from Mount Holyoke, she obtained her doctorate from the Massachusetts Institute of Technology where she later continued research as a research associate. She joined the Wellesley faculty in 1940.

Relative Humidity Symposium Proceedings Published

"The Proceedings of the 1960 Symposium on Relative Humidity and Paper Test Methods" are now available as a separate report published by the Technical Association of the Pulp and Paper Industry. The 56-page report includes nine symposium papers and discussion on the effect of relative humidity and temperature on the physical properties of paper, the measurement of relative humidity in a test room, and the design and control of test rooms. The symposium was held at the 1960 TAPPI Testing Conference under the joint sponsorship of Committee D-6 on Paper and Paper Products of the American Society for Testing and Materials and the TAPPI Testing Division.

Copies of the report may be obtained from TAPPI, 360 Lexington Avenue, New York 17, N. Y. at a cost of $1.00 per copy.

NSF Fellowships for 1962–1963

The National Academy of Sciences-National Research Council has been called upon again to advise the National Science Foundation in the selection of candidates for the Foundation's program of regular graduate and postdoctoral fellowships. Committees of outstanding scientists appointed by the Academy-Research Council will evaluate applications of all candidates. Final selection will be made by the Foundation, with awards to be announced on March 15, 1962.

Fellowships will be awarded for study in the mathematical, physical, medical, biological, and engineering sciences; also in anthropology, psychology (excluding clinical psychology), geography, economics (excluding business administration), sociology (not including social work), and the history and philosophy of science. They are open to college seniors, graduate and postdoctoral students, and others with equivalent training and experience. All applicants must be citizens of the United States and will be judged solely on the basis of ability.

Applicants for the graduate awards will be required to take the Graduate Record Examination designed to test scientific aptitude and achievement. This examination, administered by the Educational Testing Service, will be given on January 20, 1962, at designated centers throughout the United States and certain foreign countries.

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Products produced: aluminum faced panels architectural panels • automotive panels bulletin boards • curtain wall panels • cupboard doors • flush doors • furniture-wood & metal-home & office • honeycomb panels panel on frame • plastic laminating • moveable, stationary, & folding partitions • porcelainized panels • sandwich type panels styrofoam panels • store fixtures • desk, cabinet, counter, furniture & table tops • vinyl to metal • vinyl overlays • walls

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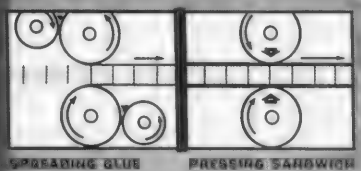
Mendota, Illinois Since 1882.
Gluing, Clamping, Laminating, & Roller Coating Equipment

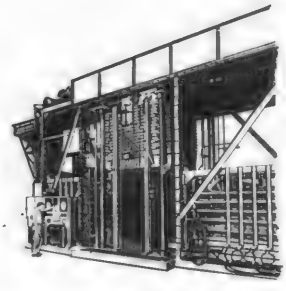
BLACK BROTHERS MODIFIED GLUE SPREADERS were designed specifically for applying contact cements and adhesives... both water thinned and solvent types . . . 8" through 134" capacities . . . single or double spreaders . . . can be arranged for alternately gluing of cores and skins of different thicknesses. Provides speed, accuracy, cleanliness and economy not attained by spraying or other methods. Write for Bulletin 11-A, part 5.

BLACK BROTHERS ROTARY TYPE LAMINATING PRESS (Pinch, Squeegee, or Nip Rolls) is the ideal press for laminating dissimilar plies when bonding with rubber base contact cements and adhesives. Available in roll widths from 8" through 134". . . . pressures up to 12,000 pounds. . . . with pressure furnished by pneumatic cylinders or heavy pressure springs. Write for Bulletin 11-C.



SPREADING GLUE PRESSING SANDWICH

This Black Brothers combination brings you the speed and economy of automation . . . a new, unmatched control of quality . . . yet provides the flexibility necessary to integrate the equipment into your present production line. Ideal used in combination, or individually.



Board plants on four continents rely on the economy, reliability and efficiency of Washington presses and forming equipment to produce board from such varying raw materials as softwood and hardwood flakes, shavings, chips, particles, wood fibers and bagasse. Though the board products differ widely in size, density and thickness, they all profit from Washington's years of experience in the design, engineering and manufacturing of press and accessory units to match individual requirements of processing methods, capacity and plant layout.

If you are considering a new board plant, or expansion or modernization of existing facilities, Washington presses and accessory equipment have a place in your plans. For information on multi-platen hot plate presses or complete particle board and dry process hardboard forming line equipment, contact Washington Iron Works, 1500 Sixth Avenue South, Seattle 4, Washington.

HOT PLATE PRESSES • PULP BALING PRESSES
SPECIAL HYDRAULIC PRESSES • AUTOMATIC PRESS LOADERS AND
UNLOADERS • COMPLETE PARTICLE BOARD AND DRY PROCESS HARDBOARD
FORMING LINE EQUIPMENT

WASHINGTON IRON WORKS

WASHINGTON PRESSES

and ACCESSORY EQUIPMENT

FPRS FOREST PRODUCTS JOURNAL VOL. XI, NO. 12 DECEMBER, 1961

A SPECIAL REPORT

The column below by R. W. Hess, director of research, Georgia–Pacific Corp., ably expresses the challenge that lies before the entire forest products industry. What is being done to meet that challenge?

To help you find the answer to that question, we asked our supporting members, our division and section officers, the U. S. Forest Service, and the technical and trade associations what their research plans held for 1962.

Some of our contributors spelled out specific research projects planned or underway. Others preferred to express their organization's research-management philosophy in terms of long-range goals.

None of the contributions contain that false sense of cheery optimism so often found in "forecast propaganda." Most of them, however, reflect a realization that industrial growth in the forest products industry will depend on its ability to provide quality wood products, consumer-oriented, and proved by research.

We hope the special report that follows will show not only what is being done—but that it will also emphasize the need for even greater effort.

Let's look ahead at our industry's . . .

RESEARCH PROGRAMMING FOR 1962

RESEARCH in the forest products industry is largely being directed toward the development of more refined products intended to fit more closely the requirements of the ultimate user. These commonly take the form of laminations or assemblies to more useful sizes and shapes, or better finishing, even complete finishing ready for use. Other than notable exceptions here and there, greatest improvements have been limited to control of quality, dimensions, and moisture content. Our technical and trade journals are filled with articles pointing out the needs for products tailored to the final use, completely and effectively finished, designed for systems that will build the structures better and cheaper. Our total progress in this direction is woefully small.

Metal and plastics, alone and in combination, are bringing out many new and effective designs. They have no history of 4′ x 8′ plywood or random width and length boards. They are tailoring their products to best suit the needs of the ultimate user at the lowest possible cost.

In the wood industry we are faced with the requirement of volume production of a low cost commodity for an entrenched merchandising organization. A completely new type of product requires a different sales approach, often by a different sales group than the one that sells plywood and lumber. Unfortunately, his customer, the builder, architect or manufacturer, is extremely slow in turning to, or even trying, the innovation. Often the very person or group that pointed out the need for the new product will do little to promote or accept it when it is offered. Doubtless this attitude stems from familiarity with the "old" and a sad history of "new" product development in the wood field.

Our need is clear. We must, as an industry, sell the idea that new and effective wood products are being tailored for consumers' needs. We must convince them that these products *are* serviceable, are modern answers to a need, and are better than similar products made from competitive materials. We *must* induce the primary user (the builder, architect or manufacturer) to accept or at least try on a considerable scale these new offerings. **This must be a combined effort by associations and the capital risk of individual companies. It must be concerted and total throughout the industry.** A combined effort by the industry should result in a most gratifying dollar return for wood substance—in new dress.

FACTORY-FINISHED PANELS, such as these by Georgia–Pacific, will serve as combination sheathing and exterior siding.

It can only happen, however, if it is backed up by imaginative solution to basic problems, tailored to the users *needs*, and with *service quality* that we can sell with pride!

Robert W. Hess
Director of Research
Georgia–Pacific Corporation

HYDRAULIC STUDIES FLUME used by Chain Belt Company to perfect methods of reducing industrial and municipal pollution of water.

CHAIN BELT COMPANY is presently engaged in one of the most ambitious research and product development programs in its history. Many of these programs deal with products used extensively in pulp and paper, and lumber operations.

Experimental work in all of Chain Belt's six different labs is aided by the latest mechanical and electronic devices available. A good deal of this equipment is so highly specialized that it must be custom built. Some of it, since it is not available in the United States, has to be imported. An example, is the recently- installed, 100-metric ton, fatigue-testing machine in the company's metallurgical laboratory. The unit, a Swiss-made Amsler, provides the firm with the largest fatigue-testing device in the chain manufacturing industry.

Another unusual piece of testing equipment is a glass flume installed in the company's Water and Waste Treatment Laboratory. It measures five feet wide and high and is 30 feet long. Its two long sides are constructed of three-quarters of an inch tempered glass, and the entire unit stands one foot off the floor. It is used in hydraulic experiments which are part of an overall program to perfect methods of controlling and reducing the industrial and municipal pollution of water sources—a matter of vital concern to forest products concerns throughout the country.

Modern testing units such as these are aiding Chain Belt's research and product development program and have played an important role in already supplying the forest products industry with such productivity-improving Rex products as: segmental rim sprockets for easier installation and unequaled wear capabilities; rotary table feeders and Carrier Natural Frequency vibrating equipment for economical and efficient handling of bulk materials; punishment-absorbing Shafer self-aligning roller bearings; and all types of drive and conveyor chains and power transmission components for pulp-mill and sawmill operations. In addition, they allow Chain Belt to provide its customers with dependable systems for conveying materials to, and from, field debarker and chipper points.

R. T. Steindorf, Director
Research and Development Center
Chain Belt Company

CASCADES PLYWOOD CORPORATION will place a concerted research effort on methods to improve the efficiency of our plywood operation, and we will concentrate more on the minimizing of residue materials in both the plywood and hardboard divisions.

After this has been accomplished, we will concentrate on the utilization of the residue materials that cannot economically be eliminated. Therefore, our efforts during the year 1962 should be to make a critical evaluation of the entire plywood process with regard to reducing the number of man hours to process a thousand surface feet of plywood. This will be accomplished by an analysis of each individual operation with regard to the capability of the different machines as well as the personnel involved in completing all integral steps in the overall process of making the finished plywood panel.

We also will continue our efforts to find less expensive adhesives for manufacturing our plywood products since this raw material is a very significant cost factor in our total manufacturing cost picture. We will be spending a good deal of time working with the raw material—namely, the log—itself with regard to improved grading methods, particularly concentrating on grading of the individual blocks that are cut from the longer logs, with the hope we can predict with more accuracy the recovery of veneer and thus improve the production planning and scheduling. We will also study cutting tolerances in the veneer clipping operation, with the goal of reducing the residue factor as much as possible.

We see a general trend towards more and more custom machining operations to be completed at the primary manufacturing plant; therefore, we expect increased activity in our custom manufacturing plant. We also are witnessing continued interest in the prefinishing field, particularly with regard to the prime coating of paper-overlaid products and the sealing and priming of hardboard products. We must keep abreast of the possibilities of producing a completely finished panel, particularly for exterior siding products to compete with the existing completely finished metal siding products; and more attention must be given to producing completely finished interior panels, which we currently are not producing. This will mean the use of hardwood face veneers or some other decorative overlay material.

With reference to new products or improvement of existing products, we are keeping a very accurate account of developments in the liquid-coating field, particularly as they apply to polyesters and polyurethanes. We are carefully evaluating some of the newer overlay materials to determine whether the approach for a completely finished panel can be handled most economically and practically by means of decorative overlays that can be combined in the primary manufacturing operation of the basic panels, or whether the treatment of the basic panel with a liquid coating material will prove to be the more practical answer to the completely finished panel. There will be many possibilities for new products that result from the combination of materials, such as the combination of hardboard and plywood, hardboard and metal, plywood and metal, hardboard or veneer with different types of lightweight core materials to produce a sandwich-type panel, in which we are searching for a composite type product that will combine the best features of the different integral materials.

J. R. Stillinger, Technical Director
Cascades Plywood Corporation

THE RESEARCH DEPARTMENT of Potlatch Forests, Inc., recently completed its pilot plant operation on a new product called Plylumber flooring. This material is a combination of subfloor and hardwood finish floor, manufactured in planks 1 foot wide and generally 16 feet long. The thickness is either 7/8 inch or 1-5/16 inch. It is glued together in three layers, with the center layer cross laminated.

The floor is laid directly on joists and the walls and partitions built up on top of it. Of course, the average builder is immediately concerned about working on top of the hardwood floor. In the more than 100 houses that have now been constructed, there has been no single report of a floor that was damaged during construction beyond damage that could be eliminated through normal sanding.

Present production is only about 200,000 square feet per month, but additional facilities are being installed with the ultimate aim of producing between 10 and 20 million square feet of the flooring per year.

Prefab Buildings

Pilot plant manufacture is underway with wooden buildings aimed at competing with the prefab steel buildings widely used for small commercial and industrial structures. The design permits a number of common parts to be used in a wide variety of building sizes and types. A further characteristic of the building is the ease and speed of erection. For example a 4,000 square foot building can be under roof in from 1 to 2 days depending upon the skill and size of the crew constructing the building. Furthermore, the building can be erected in sections and each section be completely roofed within a matter of a few hours after the supporting members have been erected.

ULTIMATE PRODUCTION OF PLYLUMBER flooring by Potlatch is aimed at 10 to 20 million square feet of flooring per year.

Potlatch is operating a pilot plant for factory finishing of interior and exterior panels. The plant is capable of producing about 5,000 square feet in 2 shifts and will be the forerunner of a commercial plant that should be in operation by the end of 1962.

Chemical Utilization

Several projects are underway in the field of chemical utilization. The Company is aiming at producing tall oil from its pulp mill liquors. Possibilities of finding raw materials for drug manufacturers from pulp mill liquors are also being explored. Recently, a fertilizer based on bark was put on the market.

H. B. McKean
Director of Research
Potlatch Forests, Inc.

THE DEAN COMPANY is mainly engaged in the manufacture and importation of hardwood veneers and lumber of various species. We operate two slicer veneer plants in the United States, one in Norfolk, Virginia, and the other in Gresham, Oregon.

Our volume for 1962 will be affected by several different factors such as the building industry, the home furnishings activities, the volume of sales in the musical instrument market, to name but a few.

However, in an overall look at the prospect for 1962, it is our studied opinion that most manufacturers who use our products have reduced their inventories to a normal or even a sub-normal level. They have developed a technique of ordering their materials as they are needed and once the products are purchased, they are shipped immediately for current usage. If you mix into this picture an increased activity and a dash of apprehension, this latter inventory picture will change to where the manufacturer will carry a better than normal inventory.

The net of all this is that we expect an increased volume and a better profit in 1962. The year of 1961 will be considered a medium good year—following 1960, which was considered an unsatisfactory year (especially for those who specialized in mahogany as our company does). The year of 1962 should prove to be a definitely satisfactory year—at least from this distance.

T. J. Connelly, President
The Dean Company

BRITISH COLUMBIA FOREST PRODUCTS LIMITED, Vancouver, B. C., one of Canada's largest integrated producers of lumber, plywood, shingles and sulphate pulp, has many studies under way to increase efficiency and reduce costs, while further increasing utilization of raw material.

One of the most interesting of these is a plan to calculate a minimum-cost log mixture for the manufacture of Douglas-fir plywood in the Company's Victoria Plywood division, which manufactures exclusively waterproof-glue plywood, in both sanded and sheathing grades.

We have two problems; first, to determine the minimum-cost log mixture for a given ratio of Sanded to Sheathing Plywood produced; secondly, to determine what ratio of Sanded to Sheathing will give the maximum profit. Since the mathematical solution of this type problem is extremely laborious, it was decided to adapt solution by a digital computer.

These programs will be run on the IBM #650 computer to be installed shortly in the IBM Data Center in Vancouver. It is estimated that only one and one-half hours will be required on the computer to run both programs. One advantage of these programs is that once set up additional data can be inserted (or removed) and changes in log prices, plywood prices, etc. can readily be incorporated in the program.

In the face of today's high log prices and low plywood prices, it is imperative that every effort be made to operate with the lowest possible raw material costs and the highest possible returns commensurate with market limitations, and it is the intention of this Company to assist management in determining this point by the use of these computer programs.

J. W. Warr
Assistant to Manager of Manufacturing
British Columbia Forest Products, Ltd.

A SAWMILL, LIKE ANY other modern processing industry, must be planned as a "system", designed to produce a specific average daily output from a specific average daily input; it must use a minimum of manpower, have a minimum of down time, and minimum of maintenance cost. The only way to achieve these goals is to plan and engineer it carefully and completely, as a system. The "systems concept", applied to the sawmill, is the way to build a modern plant or modernize an old one.

In general the lumber industry has taken to the concept of mechanization and automation. Efficiency has increased and machinery is speeded up to the point where the sawmill is no longer geared to the speed at which a man can handle logs or lumber. But sawmilling is still in the hands of men who operate on the old-fashioned "Technique Concept," which is not geared to modern automation methods; that is, the technicians who operate the individual machines—sawyer, edgerman, trimmerman, etc.—are the men about whom the new mill is built. The word "planning" is the key to the difference between just any system and a system devised under the "systems concept". Any system can be made to work after a fashion. Proper planning will make a system work better.

In sawmill design and construction, as in the design and construction of other small, modern, industrial plants, the systems concept is best expressed in the "packaged" plant, whereby a manufacturer or engineering firm agrees to construct the complete plant, start it up, and train the customer's crew—a so-called "turn-key" job. This approach is particularly valuable because the "system" is still in the hands of the manufacturer during the acceptance tests. This gives the system designer a chance to make design changes and corrective repairs while he still has the authority to do so. This testing and debugging process eliminates most of the chronic troubles. The sawmill is then operational and basically trouble-free before the operator takes it over.

We see in 1962 a growing realization by the forest products industry that automation of individual machines or parts of processes is not enough. The industry has come a long way in the last 15 years and its leaders are as intelligent as those who lead other industries. These men are beginning to realize that competitive industries have something beyond automation, and we feel that in 1962 the forest products industry, in its planning for new plants and the modernization of old plants, will begin to adopt the systems concept.

M. H. Mater, Vice President
Mater Division of
Appleton Machine Company

THE RACE BETWEEN WOOD AND OTHER raw materials for the building materials markets is more intense than ever before. Also, it has reached the point where accelerated timber growth will soon greatly exceed its consumption, and, of course, the per capita consumption of wood may drop still further. We should not press the panic button, however, for wood has many virtues as a source of building materials, both in its natural form and as a raw material for synthetic forms and compositions.

Briefly, Chapman Chemical Company's Research and Development budget for 1962 is a modest one, approximately 3 per cent of sales, but one which must be justified by the profitability of existing products in the present and the near future. Research and Development can be paid for only out of earnings, and there are too many companies who can do little or no R and D work because they sell on price alone and cut profitability to the point where no surplus or reserve for R and D is possible.

We plan primarily to improve existing products, both in utility and profitability, and also to search for new products to do either a better job, or an entirely new job in improving the utility and marketability of wood in its many forms. It is encouraging to note at least an eleventh-hour awakening among producers of forest products as to the need for research and development, and an appreciation of what an effective R and D program means in the way of costs and rewards. We trust that this present trend is a solid one. We certainly expect to expand our own program as rapidly as present and potential earnings permit.

A. D. Chapman, President
Chapman Chemical Company

EXTERIOR OVERLAY PANEL made by Georgia–Pacific in a continuous process from green veneers and wet pulp has been "weathered" equivalent of 20 years with two-coat paint job still in good condition.

FOREST FIBER PRODUCTS COMPANY has introduced two new products the past year—Sandalite, a prefinished decorative panel, and Burlite, a panel with a textured surface. Increased use of hardboard-faced plywood has also been noted during the past year.

Emphasis on product development will be toward prefinished and ready-to-use products whether they are designed for dealer or industrial use. The trend is toward products which the customer may utilize with a minimum of additional processing. The development of products for specific uses rather than all-purpose products will open new markets for hardboard.

The development of ready-to-use products has led to more processing of the board as it comes from the press. Because of this, the finishing department is being remodeled to facilitate more efficient flow of material. A pregrading line is being installed and automatic feeders will be installed on all machines. Some additional machining equipment is also being installed.

Keith Kruse
Technical Director
Forest Fiber Products Company

RESEARCH ON THE WET-WEB GLUE LINE SYSTEM (FPJ August, 1960, pp. 400–2) is being continued by the American Marietta Company and successful commercialization is expected in 1962. It is predicted that by the end of that year at least four plywood mills will be using wet-web machines to produce a total of 16 million feet of plywood, 3/8-inch basis. The system will be of particular interest to those mills which produce chiefly exterior sheathing.

High humidity stiffness improvement for corrugated boxboard is underway to provide materials which corrugated boxboard manufacturers can use to obtain urgently needed retention of most of the original crush strength and stiffness when boxes are filled and subjected to cold storage or other high-humidity storage conditions. Such additives must be low in cost, safe for contact with food products, and relatively innocuous with regard to the normal board-making process and the desirable physical properties of regualr corrugated boxboard.

Polyurethane resin formulations which can be foamed in place are being developed. The combination of wood and polyurethane foam in panels and other units will provide outstanding heat insulation coupled with other desirable physical properties, and the foam-in-place technique will greatly extend the applicability of this combination of materials.

New polymeric flocculating agents are being synthesized which will allow paper mills to retain higher percentages of fillers and fines, and at a lower cost than is attainable with presently available flocculants.

Research is being conducted on highly efficient resin systems for imparting wet-strength to paper at neutral or alkaline pHs. The resultant products should further enhance the neutral or alkaline type of wet-strength process, with the attendant advantages of less corrosion and improvement of certain paper properties.

It is anticipated that products will be offered in 1962 in all the fields described. In addition, a new liquid melamine impregnating resin for high density decorative paper overlays has already been developed and its commercial acceptance is expected in 1962.

G. F. Baxter
Manager, Information Section
Research Department
American Marietta Company

PARQUET FLOORING is one of the new products that Southern Pine Lumber Company will have on the market by the end of this year. This flooring is inlaid or Mosaic woodwork laid in geometric form; it is designed for installation on concrete, plywood, particleboard, any hard, smooth, dry surface.

Particleboard production methods with accent on the continuous processes have been under our research plan since 1955. We feel that the potential for particleboard is unlimited because of its special properties, i.e., cost, ease of working, dimensional stability, uniform surface, panel size, and uniform flatness. The integrated nature of Southern Pine's Pineland operation offers the further advantage of a use for waste from particleboard manufacture; trimmings and culls for fuel, sanding and fines to our moulded toilet seat plant.

We do not expect to bring out any new moulded products in 1962; however, we intend to follow and continuously evaluate development in school furniture parts, overlaying with plastic and veneer in our present operation, moulded boxes, drawers, T.V. cabinets, prestressed moulded boxes, insect and fungi resistant parts, and fire resistant parts.

J. C. Denman, Jr.
Vice President, Lumber Products
Southern Pine Lumber Company

CHAIN BELT CO. will continue to improve life of materials handling equipment. This segmental sprocket was installed in 2 hours instead of 30, will have at least three times the life of former sprocket.

A NEW V-GROOVING MACHINE for decorative, hardwood-faced plywood has been perfected at Greenlee Brothers & Company. This machine is designed to produce uniform width V-grooving along glue lines in order to eliminate all traces of adhesive joining.

In addition to V-grooving improvements, a special unit is also being designed for the No. 308 Gang Borer and will add angular boring to the other operations of the machine. The units consist primarily of angularly adjustable spindle housings that ride on the guideways of adjustable bases which can be set for boring angles up to 20 degrees. Special means permit power transmission from the regular top drive units.

Continuing emphasis will be given to improvements in the field of equipment for high speed sizing of panels and the associated specialty work. A soon to be installed slat bed machine will be a "specialty department in itself" with provisions for multiple splitting and grooving, scarfing, edge work such as tongue and groove or shiplap, and cutback handling.

In the field of Double End Tenoners, there will be a continuation of our developments on the addition of extra attachments for edge sanding, routing, and also more automatic handling between machines to eliminate the cost of offbearing stacking and reloading parts.

K. V. White, Sales Manager
Woodworking Machinery Division
Greenlee Brothers & Company

ROUGHNESS OF VENEER is one phase of OSU Laboratory study to learn the optimum temperature at which to peel Douglas-fir.

FIRE-RETARDANT TREATMENTS will be studied by OSU Forest Research Laboratory to learn long-term effect on strength of wood.

DURING 1962, the Weyerhaeuser Company will continue its established research and development programs in fields of pulp, paperboard and containers, forestry, and on a full line of forest products, and on the processes and materials required to produce and use these products. The major portion of this research is directed towards the creation and improvement of a line of products that will best meet the needs of the end-use consumer while bringing the optimum economic return from the forest crop harvested on our sustained yield program.

Active research is also pointed at entirely new products, ranging from moldable wood fiber material to chemicals derived from wood and bark. Other parts of the program include economic and technical evaluation of new areas which represent opportunities to integrate new businesses with company activities.

A limited portion of the research program seeks better understanding of the nature of our raw material and the changes in its properties that can be achieved or controlled during processing. This knowledge is being developed in areas which should provide the basis for new products or processes.

New Products

New products scheduled for addition to the established product lines in 1962 emphasize primed and pre-finished interior and exterior products for the building industry and for selected industrial markets. A broad line of primed softwood lumber products will be available on a regular production basis, and pre-finished siding and exterior trim will be introduced. New grades of hardwood and softwood plywood with selected finishes and overlays will be available. Paper-overlaid veneer panels with plastic-coated grain-print surfaces or embossed plastic-film surfaces are to be ready for wall or ceiling paneling. The new lines will also include hardboard and particleboard panels with coated, textured or other special surfaces.

The results of packaging research will provide "quality protected loading" for economical handling, storage and delivery of a variety of unitized lumber products. Other advances are expected in low moisture content decking materials, pre-cut and packaged stepping and Tokul Mosaic paneling. The commercialization of the new moldable fiber product, Pres-Tock, will be continued. During the coming year it is expected to prove its value in new industrial applications now under test.

Construction Methods

Our research on new methods of construction and new forms of building materials should make significant progress towards helping find better ways of efficiently using forest derived products in the homebuilding industry.

Long Term Projects

We expect further progress from our drying research in the form of better quality, more uniform moisture, less degrade and shorter drying cycles. It is not likely that evidence will appear during 1962 in the market place from the long range studies on new approaches to cutting, finishing and bonding, but several of the recognized technical hurdles in these areas will be better understood and probably solved to point the way for applied work which can be scheduled for completion in the foreseeable future.

A. S. Gregory, Director
Research Division
Weyerhaeuser Company

SUMNER IRON WORKS will continue efforts to improve the design of the machinery items involved in log deck equipment. We have a few relatively minor design improvements which we intend to incorporate in our band mills within the next few months. Also, considerable study is indicated on edger machines. The advent of the remote control push-button-type saw setting systems indicates that some change in design of the conventional edger would be desirable.

Closely related to the edger is the edging picker. These machines are rapidly becoming more popular and there is a definite need for design study to be concentrated on them. The line-bar type of band resaw is rapidly taking over, and we are continuing our study and design work on the line-bar unit of this combination.

We are continually studying the problem of efficient chipping of slabs and edgings, and we will continue to improve present designs as well as offer new designs for this type of equipment in both the gravity and the horizontal feed chippers. We feel that there is still an opportunity to improve the accuracy and the cutting action on these machines which, in turn, will tend to improve the uniformity of chips produced.

Considerable design work has been accomplished on chip screening equipment and in addition to our regular line of chip shaker screens, some of which are self-balancing in design, we have recently completed a design of a rotary shaker type screen which will be brought to the attention of prospective customers within a short time. For many years, Sumner has offered steam or air operated log splitters for splitting logs up to about 4 or 5 feet long and capable of handling the normal diameter log. Recently, however, we have designed a hydraulically operated log splitter which is capable of not only handling longer logs but is also capable of splitting the larger diameter logs into a greater number of pieces at one operating stroke.

W. A. Wallace, Manager
Forest Products Machinery Division
Sumner Iron Works, Everett, Wash.

THE BORDEN CHEMICAL COMPANY'S forest products research effort in 1962 will be concentrated in the areas of improved board-making processes, development of new and improved resins, and investigations into a broad variety of surface treatments.

We are examining manufacturing techniques at board plants to determine what modifications can be made to make more efficient use of resin binders. Although this work is not normally the job of the resin supplier, we feel it is of the utmost importance if board products are to retain their competitive position with relation to other building materials. We have undertaken a broad program in the process field in anticipation of an accelerated national building effort within the next 5 years. To illustrate the need for such research, physical losses of resin in overspray, edge trim and sander dust, plus functional losses through poor distribution and precure, indicate that reductions of up to 50 percent of resins used are possible through improvements in board manufacturing techniques. Under present systems, about 30 pounds of each 100 pounds of resin employed do not appear physically in the final product, and approximately 20 pounds do not appear functionally in the finished board. The competitive position of both plywood and particle board in the not too distant future may largely be determined by economic resin usage.

New Research Laboratory

In support of such studies, our company has supplemented existing facilities with a new forest products research laboratory, opened in Springfield, Oregon earlier this year. This new operation incorporates complete research-size production equipment that is designed to approximate, as nearly as possible, actual operations.

More Efficient Resins

We are working to create new resins and to raise the efficiency of the commodity-type glues now in use by investigating ways in which these materials can be modified to meet process limitations. We will also expand our phenolic resin research. Federal Housing Administration approval of phenolic particle board for certain non-structural exterior applications, passage by Congress of bills to stimulate residential construction, and lower material costs have created a greater sense of research urgency in this field.

AS A RESEARCH FACILITY for the Northwest forest products industry, Borden Chemical's new Springfield, Oregon lab is built entirely of wood —framing, cedar siding, and rugged laminated timber beams.

Our company will also concentrate on further developments in resorcinol resins, which find major use in laminated timber beams. A national architectural trend toward buildings of unusual geometry has stimulated considerable interest in wooden beams. Treated laminated structural members of wood have greater resistance to collapse by fire than steel. They allow designs of longer, unsupported spans, and offer less weight per unit of strength than steel.

Surface Treatments

We are expanding our studies of surface treatments, in inks, lacquers, film raw materials, base coat materials, and finished coatings for siding and roof applications, to meet the ever growing demand for factory-finished products.

Our research effort next year and in the years ahead will be an active one. We know, as do many of our partners in this field, that forest products industry growth will be closely related to the research effort that backs it up.

A. M. Marusi, President
The Borden Chemical Co.

NOW TAKING SHAPE ON A 150-acre site fronting on the Columbia River at Kalama, Washington, is the Dow Chemical Company's 36-million pound phenol plant.

The Kalama facilities will enable Dow to serve all geographic segments of the forest industry from regional production plants and offers dramatic evidence of Dow's willingness to back its faith in the future of an industry with substantial capital investment.

As a supplier of chemicals basic to the wood industry, Dow has a tradition of basic research and is now accenting applied research and product development activity keyed to the needs of the industry. The need for engineered products designed for specific end users to help offset competition from metals and plastics is recognized. It is also felt that there are many possibilities to capitalize on market potentials through the use of wood in combination with the competitive materials, and these possibilities will not be overlooked.

Specific Research

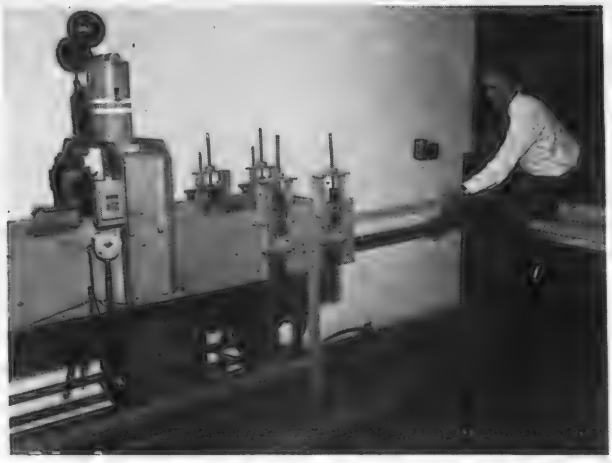
Dow is rapidly increasing its adhesives technology and is accentuating developments which tie in with industry goals of automated systems. Developmental polymers and condensates are being screened for applications as liquid binders in particleboard and hardboard.

A major producer of pentachlorophenol, Dow is long on technology in the preservative area and sees substantial growth through the increasing awareness of the importance of preservative treatment of many structural lumber items.

Tied in with an interest in dimensional stabilization, is Dow's background as a glycol producer. This is another area in which Dow has initiated development activity with a specific end use in mind and in the knowledge that improved dimensional stability and better drying would permit production at closer tolerances—a necessity in the face of stiff competition.

In addition, Dow research may probe the use of wood wastes as raw materials for the production of chemicals. Positive results here would certainly be a shot in the arm for the forest industries and also would put the chemical company with regional production facilities in a favorable position as both a supplier to and a customer of the lumber industry.

E. J. McVeigh, Public Relations
Chemicals Section
The Dow Chemical Company



STRESS-O-MATIC machine developed by Western Pine Association will be used to stress-rate lumber rapidly and accurately.

THE NATIONAL WOODEN PALLET MANUFACTURERS ASSOCIATION has ambitious plans in the field of research and development for 1962. For the first time, a reasonable fund for research and development will be available to this industry.

Foremost of the projects will be the continuation of a research study entitled "The Coming Revolution in Packaging and Materials Handling." The "Buy from Pallet" system, which has already been developed, will be unveiled to the consuming public for the first time. This system offers more than 20 additional savings over present packaging and handling techniques even when the consumer is employing the best possible techniques. It involves the use of pallets and pallet containers all the way from raw materials through processing, manufacturing and distribution direct to the consuming public, and applies to all mass produced or volume items.

Other pressing problems will be the study of improved fastening techniques, the finding of ways and means to improve and lower the cost of pallet manufacturing, the continuation of the study of methods of assembling pallets with adhesives, and a survey of the economic value of pallet products to consumers.

New Pallet Nail Standards

The development of new pallet nail standards has been in progress for the past 18 months. Its prime purposes are to develop improved designs of deformed shank nails, to lessen wood splitting, and to improve further the good holding qualities of this nail. Work on this project is also being devoted to the study of the quality of the steel wire used in pallet nails, and in the construction of the thread. Work to date indicates possible changes in the NWPMA standard nail specification some time during 1962.

A genuine need exists for more design work on collapsible and noncollapsible pallet containers, particularly the improvement of present hardware for such containers. In a very few years the demand for wooden pallet containers is expected to exceed the present demand for flat pallets. Large potentials are possible for manufacturers of hardware for pallet containers, which possess ease of application and assembly coupled with low cost.

W. H. Sardo, Jr.
Executive Vice President
National Wooden Pallet Manufacturers Association

THE 1962 PROGRAM OF RESEARCH and development for the Western Pine industry will continue to be as diversified as it has over the past years.

Service to our member mills will be mainly in the form of seasoning consultation calls to reduce the overall time and to increase the quality of production through new seasoning techniques. Field studies of production techniques, degrade occurrences and others will be carried on as well as all types of equipment evaluation for the mills use.

Finishes, Overporosity

The search for exterior clear finishes continues. Dimensional stability is a subject that is constantly being reviewed. Various treatments are being applied and evaluated for the brown stain problem on ponderosa pine. This staining is related to log storage, so much of our effort has been centered on field studies to determine the effect of storage periods in log ponds, dry decks, and sprinkled decks.

The overporosity that develops during log storage is a problem to the sash and door industry. When the material is treated with preservative solutions, it absorbs an excessive amount which does not dry readily and causes paint problems. Preliminary studies indicate that salvage of this overtreated material is possible by high vacuum. This problem seemed to be confined to the pines but as prepriming and prefinishing is practiced on other species, this problem is becoming universal.

Product Development

More emphasis will be placed upon the product development during the coming year and efforts will be devoted to products that can be produced by lumber manufacturers. In the field of utilization we will continue to review the efforts by other laboratories and to develop products or processes that appear to be commercially feasible.

Improved realization from our lower grades is and will continue to be a large portion of our program. Our efforts to develop structural finger joints in the production line is now commercially possible. In the coming year we can expect a great deal of expansion in this field, not only from the utilization of short material but up-grading by removing the large defects. Our quality control checking has shown that the mills are able to produce joints of structural quality so we are making the control system more rigid and applying to FHA for the use of finger-jointed lumber interchangeable with stress-rated solid material.

Plant Quality Control

The development of a device to reduce the cost of plant quality control and to test all of the joints in the production line is now a reality, and production of commercial equipment will be available this coming year. This has led to the development of a nondestructive system of stress-rating dimension lumber. The Stress-O-Matic machine for mechanically stress rating lumber in the production line will soon supplement the visual grading system with greater reliability.

Our device to automatically detect and cut out defects in lumber is soon ready for its second field test and ultimate manufacture. This particular unit is to be used for cutting lumber to 20 predetermined lengths. When this task is accomplished the detector will be developed for automatic patching, sorting and the detection and actuation of other equipment not only for lumber but the other forest products (plywood, hardboard, paper, etc.) and the ultimate goal, of course, will be that of grading.

C. A. Rasmussen
Director of Research
Western Pine Association

THE DOUGLAS FIR PLYWOOD ASSOCIATION plans to expand its research activities in 1962 and to place greater emphasis on a basic approach to developing strength characteristics of plywood, as well as an intensified investigation of exterior coatings and a substantial increase in work on pallets and containers.

Plywood Strength Study

The plywood industry is interested in establishing a more refined and reliable method of deriving the strength of plywood and accounting for all the natural and manufacturing variables that go into the panel. The problem is complicated by the increasing use of Western softwood species other than Douglas-fir. It is further sharpened by the necessity for closer utilization in various end-use products.

One phase of these investigations is being conducted in cooperation with the U. S. Forest Service and the Forest Products Laboratory. Their Increment Core Study of densities of various Western softwood species, which is being sponsored cooperatively by the DFPA, West Coast Lumbermen's Association, and the Western Pine Association, will permit a re-evaluation of basic stresses for nine major West Coast species. This program is scheduled for completion in mid-1964. Concurrently, the DFPA will conduct additional studies on material matched with the FPL study, designed to establish a relationship between the strength of wood and plywood. At the same time, the effect on various strength properties of grade defects and manufacturing variables will be evaluated. This work is also being coordinated with similar work on plywood strength properties being conducted by the Canadian Forest Products Laboratory at Vancouver.

Industrial Applications

The large potential market for plywood in pallets, containers, and large shipping crates, will be pursued aggressively. Design criteria will be developed and fastening methods will be investigated. Comparison of the advantages of nail-gluing as compared with nailing only may also be explored.

The present DFPA program for evaluating exterior coatings will be expanded. The purpose of the program is to make plywood more suitable for exterior applications by developing low-maintenance finishes of exceptional durability. A similar program will be started on interior finishes and possibly on industrial uses.

Prefinished Panels

Methods of applying prefinished plywood siding without damaging the finish will be explored further on both flat panels and lapped siding. All important phases, including opening details, application of trim, caulking, and similar problems, will be investigated.

Fire Tests

Additional work will be carried out to develop improved code acceptances and insurance ratings for plywood in construction. Particular attention will be given to fire-retardant treated material, both in conventional applications and in prefabricated components. The problem of gluing fire-retardant treated material may receive additional attention. Various promising surface coatings will also be checked.

Structural Applications

Work on the development of various structural systems utilizing plywood will be continued. Rigid frames using plywood gusset plates and wood or plywood framing members will be engineered and tested with a view toward developing a complete structural system utilizing frames and panels. This system may be utilized in a proposed scheme for low-cost housing, as well as in the more conventional system of prefabricated commercial and industrial type buildings.

Design work on trusses using plywood gusset plates will be continued. This may include further work on the durability and rigidity of the glued gusset joints.

J. M. Hess, Technical Director
Douglas Fir Plywood Association

WITH THE EXPANSION OF THE National Wood Promotion Program, the National Lumber Manufacturers Association is participating in an increasing number of research activities. At present, over $100,000 per year is being budgeted for technical investigations and surveys. In general, these projects are aimed at developing information that can improve the competitive position of wood in the important building construction industry.

A major project currently underway is an evaluation of various types of wood floor systems at Washington State University. Work is focused on frame floors with a shallow crawl space to serve as a plenum for heating and cooling. The objective is to develop a wood floor system which will be more competitive with the concrete-slab floor.

Home Planners, Inc. of Detroit, Michigan has undertaken the development of a standardized system of wood construction in another NLMA effort to facilitate improved wood construction, and provide a system of house construction which will coordinate the production and use of standardized components without sacrifice of design flexibility.

During the past 2 years a study of comparable insulation properties of frame and masonry construction has been conducted for NLMA by the Timber Engineering Company. The results will be used in preparation of a new publication to point out the insulation benefits of wood to architects, builders, and home owners.

Another extensive study is aimed at improved performance for finishes on exterior wood. As a beginning, the requirements for improved wood finishes and most promising avenues of research were discussed at a comprehensive Lumber-Paint Industry Conference in New Orleans in April of this year. It is expected that a jointly sponsored project for developing modification of the film-wood interface to provide increased durability of exterior clear finishes will be undertaken shortly. An integral part of the study is the development of improved clear finishes adapted to the modified wood.

A proposed fundamental research project is concerned with the combustion of wood to assist in establishing valid fire-resistance ratings for wood construction.

In addition, railroad bridge stringers will be studied for new methods of assembly, load distribution in multiple member assemblies, improvement of information on fasteners, and development of a more accurate determination of the strength of lumber.

Besides the more obvious benefits to be expected from the data development projects that are under way or proposed, information derived will also be useful in accomplishing other industry goals. For instance, grading and lumber-use studies are invaluable in arriving at ways to simplify and standardize lumber grading.

J. I. Zerbe, Assistant Director
Engineering & Technology
National Lumber Manufacturers Association

THE HOME BUILDING INDUSTRY provides an immense market for forest products and all indications are that this market will expand in 1962. For every 100,000 new homes built, a market is provided for 975 million board feet of lumber, 115 million board feet of finish wood flooring, and 104 million square feet of softwood, plywood.

A healthy home building industry means prosperity for those engaged in the production, utilization, and distribution of forest products. The rate of home building strongly influences the demand for not only the materials of which houses are built but their furnishings. A neighborhood of new homes also creates a demand for stores, schools, churches, bowling alleys and other structures.

With our population at more than 180 million persons and growing at the rate of about 3 million a year, we will need roughly 16 million new homes in this country in the 1960's. If we are going to do more than just stand still, we will need far in excess of 16 million new homes. But even the minimum will mean an expenditure of about $230 billion for residential construction over the 10-year span.

Important Markets

One of the most important markets is that provided by lower income families. Members of the National Association of Home Builders have been developing this year a high value low-priced home that can be produced in quantity for this market. The results of their individual work are to be pooled and it is expected that many more such homes will be built in 1962.

Another specific market for homes—and one that is growing daily—is created by the large number of retirees. There are more persons 60 years of age or older today than there were in our entire population at the time of the Civil War.

We must provide, too, housing opportunities for minority families, and for the citizens of smaller towns and cities which, perhaps, have not been given as much attention as other areas, particularly in the rush to end the postwar housing shortage.

In addition, there are many families who have adequate shelter now but wish to upgrade their housing situation, renovate and modernize.

Personal incomes are climbing at the rate of about 2 percent each year. It is thus clear that from the standpoints of need and personal incomes alone, the home building industry will remain strong and continue to serve as a bulwark of the economy as a whole, including particularly, the vital forest products.

J. M. Dickerman
Executive Vice President
National Association of Home Builders

COATINGS FOR RANCH PANELS, completely prefinished Douglas-fir exterior panels by Georgia–Pacific, have been evaluated in weathering tests at G-P labs. Five colors will be available in 1962.

THE NATIONAL WOODWORK MANUFACTURERS ASSOCIATION (NWMA) foresees a broadened and enlarged research program in 1962 by manufacturers of stock woodwork products. The following projects will be conducted under NWMA guidance.

Water-Repellent Preservatives: This project is now more than 20 years old, but it still ranks high in importance among the industry's research programs. The objective is to overcome the effect of moisture and temperature changes,—shrinking, swelling, warping and decay. For the past several years, the association has sponsored a cooperative research project with the U. S. Forest Products Laboratory to discover the best methods for testing the toxiciy and water repellency of wood-treating solutions. This project will be continued during 1962 to determine how closely the results of outdoor exposure tests coordinate with laboratory tests.

Paint Discoloration: In collaboration with the National Paint, Varnish and Lacquer Association, NWMA will continue tests to determine what causes paint discoloration on woodwork products and how to eliminate it. This study was begun in the fall of 1960 and probably will be concluded late in 1962.

Overporous Lumber: Most woodwork manufacturers will agree that exterior wood products should be treated with a water-repellent preservative to prevent decay and minimize shrinking and swelling. Overporous lumber becomes a serious problem because of excessive absorption of treating solution. During 1962, NWMA will continue to collaborate with the Western Pine Association in a field study to find a practical method for preventing overporosity.

Flush Doors: As a result of several years of study in which the Forest Products Laboratory has played a leading part, NWMA will publish a guide for the prevention and control of warp in flush doors early in 1962.

Building Components: In harmony with the present trend toward the use of prefabricated building components, particularly in residential construction, NWMA is collaborating with the National Lumber Manufacturers Association in a program for integrating windows and doors into prefabricated wall panels.

J. E. Nolan, Secretary-Manager
National Woodwork Manufacturers Association

THE CALIFORNIA REDWOOD ASSOCIATION EXPECTS TO CONTINUE RESEARCH in cooperation with the California Forest Products Laboratory on a study of redwood extractives. This project has been in progress for a number of years with the objectives of determining the chemical nature of redwood extractives and providing information which would enable us to reduce or eliminate extractive strains which occur in redwood lumber.

We are also initiating at the Laboratory a program with the objective of improving the air and kiln seasoning techniques practiced in the redwood region. We feel that a study of our methods will result in a substantial improvement in seasoning practices. Solvent seasoning of redwood lumber ranks high in our plans. In the past year, we essentially completed the laboratory phase of this project and, in the coming year, intend to study plant design and get a better economic evaluation of the process itself.

We will also start on an evaluation of the characteristics of young redwood timber, including an analysis of its characteristics and suitability for various products.

We also expect to continue our investigation of concealed fasteners for redwood siding, components, and special patterns and products with the objective of increasing the use of redwood in as broad an area as possible.

W. A. Dost
California Redwood Association

U. S. Forest Products Laboratory
Forest Experiment Stations
Division of Forest Economics and Marketing Research

THE UNITED STATES FOREST SERVICE conducts research in all phases of forestry—forest management, forest economics and marketing, forest protection, and forest engineering as well as forest products utilization. This research is conducted at 10 regional Forest Experiment Stations and the U. S. Forest Products Laboratory.

The center of forest products utilization research is the Laboratory at Madison, Wisconsin. Research here is coordinated with regional research conducted at the Experiment Stations. In some instances, research is conducted jointly by the Laboratory and one or more stations. In other instances, each unit conducts independent research.

In addition to regional research and cooperative research conducted by the stations, each station has a group of specialists who act in liaison between the Laboratory and regional interests. In effect, they bring the Laboratory to each region. These specialists continually study utilization problems, appraise them, recommend priorities for action, and stimulate needed research both within and outside the Forest Service to find solutions.

Station Research

One major trend in Forest Service product research is thus the work being done by the Stations' divisions of forest utilization research. Since these investigations center primarily about local needs and problems, the program at each Station differs somewhat from that of the others.

Reasonably typical, however, is the research under way at the Northeastern Station, Upper Darby, Pa. Here work is actively under way with universities, trade associations, forestry departments, equipment manufacturers, and individual industries on the local application of research results. This work is intended to stimulate the use of hardwoods both as round wood and chippable sawmill residues at pulp mills; charcoal production; remanufacture of sawed products at or near sawmills; and improved efficiency of logging, sawmilling, and manufacture of wood products through use of automatic equipment and more efficient methods.

Soon to be built at Princeton, W. Va., is a new forest utilization and marketing research center. Promising new uses for local species will be demonstrated, and a 5,000-acre experimental forest will be operated on a nearby state forest for the study of improved methods of managing local stands. A concentration yard for products of local stands, where methods of cutting and sorting for maximum value yield will be developed, is also being considered.

How work differs from Station to Station is illustrated by the Northeastern Station's next-door neighbor, so to speak, the Southeastern Station at Asheville, N. C. Problems under study here include procurement, manufacturing, processing, and fabrication of wood, involving fundamental and applied research at Asheville and various field locations. At the Athens, Ga., research center work on charcoal production, wood preservation, and paper overlaid lumber is under way. Pilot-type developmental work is planned on overlaying of southern hardwoods, preservative treating, and related research. Cooperative work is under way with North Carolina State College, Duke University, the University of Georgia, the Georgia Forestry Commission, and the Georgia Forest Research Council.

U. S. FOREST SERVICE

NATIONWIDE PROJECT on quality of standing timber is in full swing by the USFPL and the Forest Experiment Stations. One important phase is the collection and analysis of increment cores.

Environmental and hereditary effects on wood properties are being investigated on yellow-poplar, slash pine, and white ash as part of research on wood quality. Another phase of this investigation is a study designed to determine the variability in distribution in size of the structural communicating capillaries in softwoods.

Effects of environment, including temperature, moisture, and such deteriorating agents as decay and insects on wood in use, are being attacked through study of the treatment of green veneer with preservatives, the evaluation of double-diffusion treatment of hardwood fence posts, a study of the rate and degree of deterioration of gum and oak pulpwood chips stored in the open, a test of the durability of paper-overlaid oak and hickory in service, variations of moisture content in southeastern homes, and pretreatment of pine poles having bark-chipped, acid-treated turpentined faces to increase penetration and retention of creosote. Related studies deal with the properties, molecular structure, rate of polymerization under different conditions, and techniques for characterization of urea resin adhesives.

At the Central Station, Columbus, Ohio, comparable work is going on, much of it in cooperation with Southern Illinois, Iowa State, and Purdue University. Various processing and use experiments are centered on hardwoods at the Carbondale, Ill., Research Center, including exposure studies of paper-overlaid cottonwood siding, nailing characteristics of air dried red oak lumber, air drying of red oak and yellow-poplar, sawmilling of red oak, and studies of tension wood in oak furniture cuttings. Effects of moisture content on performance of red oak bin pallets in an apple grower's warehouse are being investigated. A basic investigation of the feasibility of gamma rays for detection of defects in wood, and development of electric load cells for determining moisture content changes in lumber during kiln drying, are among the more basic studies.

The value of preservative treatments for farm structures is being assessed in various ways at the Lake States Station, St. Paul, Minn., among the structures being a University of Minnesota pole-frame turkey barn. Other investigations include kiln drying characteristics of thick beech dimension stock, treatments to prevent deterioration of logs and pulpwood during transit and storage, toxic precipitates for preservative treatment of various species, and design of charcoal kilns.

Among studies under way at the Pacific Northwest Station, Portland, Ore., are continuing studies of the effects of exposures on glued laminated structural members of bridges, schools, and other buildings. Among seasoning research projects is one on kiln degrade occurring in western hemlock. The Pacific Southwest Station at Berkeley, Calif., is planning a new project on the strength and related properties of wood from killed timber, and is testing electronic moisture content detection devices for the kiln drying of white fir.

The Rocky Mountain Station, Ft. Collins, Colo., has under way durability investigations of various local species for use as posts, poles, railroad ties, and other products in the Southwest. It is winding up a study of logging residues that showed beetled-killed Engelmann spruce to be well suited for particleboard.

Among studies at the Intermountain Station, headquartered in Ogden, Utah, are several affecting utility of wood poles. One deals with effects of heat drying of lodgepole pine and western larch poles on preservative retention and penetration. Another seeks relationships between twisting of poles in service and spiral grain developed during tree growth. The effects of environment and silvicultural treatment on growth rates and physical structure of western larch are also under study.

At the Southern Station, New Orleans, La., predrying of 4/4 red oak lumber is being tried as a substitute for air drying, in cooperation with the University of the South. The true value of pile covers and ground covers used in connection with the air drying of 5/4 red oak lumber is being assessed.

Similar work on Alaskan species and utilization problems is scheduled for the Northern Forest Experiment Station at Juneau. Local conditions of use there can be quite as distinctive as those in any other part of the country. Likewise, a certain amount of localized utilization research is under way at the Institute of Tropical Forestry in Puerto Rico on preservatives and treatments, seasoning, and related use problems.

CHEMICAL UTILIZATION at USFPL will continue with such studies as microfractional distillation of components of bark and extractives.

Basic Research at U. S. Forest Products Laboratory

A second trend in Forest Service product research is a new emphasis on basic research at the Laboratory in Madison. This by no means implies that applied research will henceforth be down-graded or neglected. The many valuable contributions to our forest-based industries that have sprung from past applied research are sufficient evidence that this type of research will continue to have a vital role in our program. In fact, the trend toward basic research is spurred by the need for new knowledge with which to reinvigorate applied research and thereby stimulate fresh attacks on today's utilization problems.

In a research program so extensive as that under way at Madison, it is patently impossible to give in this article more than indications of the trend toward greater emphasis on fundamental research. From among the many that might be cited, I have selected a dozen or so examples of projects that place emphasis in this direction.

In our work on wood preservation, we have only in the past year been able to acquire the full-time services of an entomologist. Yet, already this investment is paying off in new knowledge of the habits of termites. It has been found, for example, that some types of decayed wood contain a powerful attractant for termites. We are at work now on related research to determine whether other types of decayed wood contain similar attractants. It may prove to be a lead to entirely new concepts of protecting wood structures from the ravages of this insect.

We are also pushing research on the recently discovered "soft rotters," or *Fungi imperfecti,* to learn more about their life cycles, habits, and other basic knowledge needed to devise better protection from their ravages. And we are continuing to follow lines of basic research that give promise of eventually producing nontoxic means of preserving wood from decay.

One of the major needs of builders of houses and other wood structures is faster, more reliable ways of fastening component parts together. The strong trend today in the building field toward factory-made components for assembly at the building site makes new types of fasteners even more desirable. New methods of assembly can best come, we believe, from basic research on adhesive formulation. One line of investigation aimed at new and lower cost adhesives is centered on the potentialities of bark and extractives as adhesive sources.

What causes paints and other wood coatings to deteriorate? Research on the chemical and physical breakdown of wood finishes is also under way along fresh lines. Some means of arresting deterioration is sought; to attain this, a better understanding is needed of what really takes place in a finish as aging continues under various conditions of exposure.

Along parallel lines, the photochemical effects of light on wood are being studied as possible leads in the development of durable, permanent natural finishes. Also being sought is information on the magnitude of stresses exerted upon the finish and wood when dimensional changes are induced by moisture. Formulation of improved finishes designed with such requirements in mind is an ultimate objective.

In much the same way, new paths of investigation are being followed to learn the effects of heat and fire on wood. We are familiar with the good fire resistance of heavy timber construction, its tendency to char and thus insulate itself. We know empirically that wood in the small dimensions can be made more fire resistant by impregnating it with substantial amounts of suitable chemicals. The ultimate aim of the new investigation is a thorough understanding of what is involved in the thermal decomposition or pyrolysis process for wood and how it can be altered. Such knowledge may reveal links in the process that we can control and thereby make wood even more fire resistant.

Research on the physical and mechanical properties of wood has been under way for as long as research of any kind. It has long since become apparent, however, that empirical testing of clear wood and various structural elements containing strength-reducing characteristics cannot yield all the answers to questions about wood strength. The design criteria evolved from such testing must account for the variability within each species, so that an unknown but surely substantial proportion of wood is not utilized at its fullest strength potential. Obviously, we need to develop more precise methods of evaluating the mechanical properties of wood as it comes from the saw, regardless of the slope of grain, size and distribution of knots, and other characteristics now heavily involved in these "judgment" considerations.

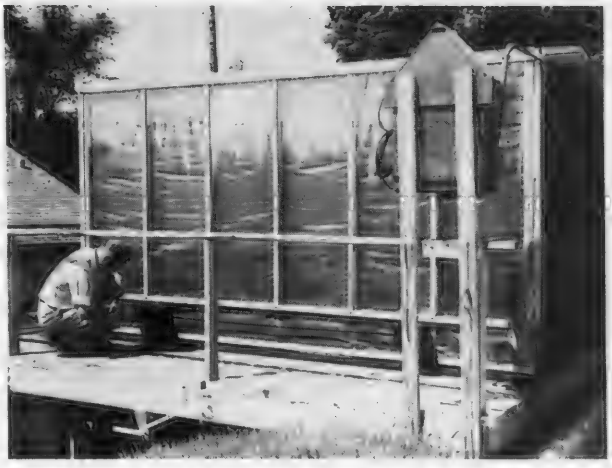
Among approaches we are exploring to find more accurate ways of evaluating wood for strength are the potentialities of radioactive sources for determining density and moisture content. Here may be a means for mastering the elusive technique of what we call nondestructive testing—that is, a means of determining the strength properties of a structural member instantly without damaging it, yet with sufficient accuracy to assure its efficient use in a structure. But again, much basic research is needed.

One is inclined to regard packaging investigations as strictly in the category of applied research. Yet in this field, for example, we are doing most of our basic studies on the theory of design of fiberboard and structures made with it. While the fiberboard box is the chief target, the findings are expected to be applicable to whatever structural use we choose to put this important wood product. In a related field of packaging research, cushioning, fundamental studies of dynamic energy absorption characteristics of various materials are under way. Like many others, this field is so new that often special electronic instrumentation must first be developed for various kinds of proposed cushioning materials. Much the same is true of the studies of holding power of nails, bolts, and screws under dynamic loading conditions.

The physical structure of wood has been studied by many under the microscope. Yet we are finding that this field of research holds promise of much fruit, and are expanding it at Madison. With light and electron microscopes, we are attempting to map more precisely and minutely the labyrinth of wood's fine structure. The ultimate goal, of course, is to relate the structure of wood more intimately to its strength and physical properties. This research cuts close to the heart of true forestry by revealing relationships of growth and structure of properties.

The manufacture of better pulp fibers from wood undoubtedly will depend on obtaining new and more complete knowledge of the fine structure as well as the reactions of the major chemical constituents of wood. We find the studies on the rheological properties of the cell wall in wood subjected to varying degrees of chemical treatment still more intriguing. To obtain a pulp with good strength properties, it is essential to remove the outer cell wall layers, which interfere with bonding of fibers, from the inner ones, which constitute the backbone of the fiber. Because of distinct differences in composition and fibrillar arrangement, the adhesive between these layers could be easily overcome by the proper combination of chemical and mechanical treatment with least damage to fiber strength while imparting maximum fiber bonding.

As a source of chemicals, wood has proved to be rich indeed. One stumbling block to its more complete utilization in this way, however, continues to be our lack of understanding of its second most abundant chemical constituent, lignin. The allure of this enigmatic substance is so strong that research on it is being pushed in many places. Even its chemical characterization eludes science. We are enlarging our research effort on it. Obviously, here is a real challenge to fundamental research workers. Similar studies are under way on the chemicals obtainable from bark and the extractives of wood.



SEASONING RESEARCH at the U. S. Forest Products Laboratory will include development of this solar "predryer." Similar dryers will be erected in Puerto Rico and elsewhere in the United States.

The main problem in the chemical utilization of wood is how to convert profitably our great quantities of wood residue and low-grade wood to useful products. Our approach to this problem is to study the basic chemistry of processes by which wood can be fractionated to its main components, and then separately study the chemistry of the conversion of the fractions to tonnage chemicals. A final stage in such process development is the testing of critical process steps in a pilot plant.

Investigative work on the fundamentals of adhesion includes studies of some of the factors that influence the degree of physical interaction of polymers from solution with wood substance. This is fundamental work of the highest order of physical chemistry, and holds a key to better understanding of adhesion that can unlock doors now blocking our way to more effective bonding of wood to itself or to other materials.

An investigation of climatic effects on various wood products, such as laminated wood, plywood, and particleboard, is in progress. Four exposure sites have been selected: near Olympia, Wash., Fresno, Calif., the Harrison Experimental Forest in Mississippi, and Madison. Next year we expect to have specimens mounted at all of these sites for study, among other things, of microclimate effects.

These examples of the greater emphasis now being placed on basic research typify the trend of research at the Madison Laboratory. From them and others, we expect that in time will come much-needed new knowledge to reinvigorate our broad program of applied research, which the forest products industries have found so helpful in the past for maintaining and increasing their economic vitality.

"National" Projects

A third trend in Forest Service research is the establishment of several so-called "national" projects jointly carried on by the Laboratory and the Stations. In various stages of development now are projects dealing with: lumber grade recovery from softwoods and hardwoods; development of log and tree grades; evaluation of the quality of standing timber by increment core analyses; environmental conditions that affect wood in use; and various wood-seasoning studies attacking regional problems. In addition to these, an exploratory study of the factors that affect wood quality is under way to develop a broad new concept for research on quality improvement by genetic, silvicultural, and other means.

One such project, on research on the environmental conditions that affect wood in use, is designed to give a much

more comprehensive analysis of such factors as temperature, moisture, loading conditions, fire hazards, decay, and weathering. How these affect wood structures in various parts of the country is at once a basic and a highly practical type of research. Measurements of temperature of framing lumber have been conducted at Athens, Ga., Tucson, Ariz., and other points.

Plans for expanded seasoning research at forest experiment stations as well as public and private cooperating agencies are in the formulating stage. Some work, however, is under way; for example, at forest research centers in Alexandria, La., Stoneville, Miss., Carbondale, Ill., and Athens, Ga. The object is to orient research more closely to local conditions, so that basic investigations at the Laboratory can be put to use more effectively and quickly by industry. Among processes scheduled for investigation in local applications are solar drying and low-temperature predrying.

Another of these national projects, designed to put basic research findings to use on a nationwide scale, is a tree core density study. This work, now under way in the South, the East, and throughout the West, consists of a wholesale sampling of standing timber by extracting increment cores for density and other analyses. This investigation, launched by the Laboratory and the Southern Station several years ago in Mississippi, has snowballed—and for a very good reason. It is the first statistically rational large-scale effort ever made to assay the quality of standing timber.

There are, of course, many ramifications to this "timber quality census," as it has come to be called. Its broad practical significance is, however, perhaps best attested by the fact that industry has whole-heartedly cooperated. In the West alone, $300,000 is being made available by the West Coast Lumbermen's Association, the Western Pine Association, and the Douglas Fir Plywood Association. Industry leaders are acutely aware that the information this census will develop about quality has basic value for the intelligent planning of future operations.

The fact that practical businessmen are awake to the significance of such once-abstruse concepts as specific gravity, fibril slope, and carbohydrate-lignin ratios speaks well for future progress in the forest industries.

The broad scope of Forest Service research can only be indicated by example in such a condensed review as this. Indeed, something omitted from mention here may in the near future rise from obscurity into a dominant position commanding special attention. In research, one cannot afford to be dogmatic in evaluations of future benefits. One can only pursue as broad a line of investigation as is possible with available funds and facilities, confident that continued accumulation of new knowledge will lead to more efficient utilization of wood. Basic research is an indispensable precursor of progress.

E. G. Locke, Director
U. S. Forest Products Laboratory

THE FOREST SERVICE has underway a number of continuing studies of current and potential wood consumption for various end uses. Such information is essential to the development of sound forest policies and effective business planning. During 1962, the Division of Forest Economics and Marketing Research will be engaged in studies to provide needed information on the following areas.

Wood Use in Residential Construction

The study will determine 1) the amount and kind of lumber, plywood, particleboard and hardboard used in single-family, detached, FHA-insured houses built on-site during 1959, and 2) the effect of type of construction, structure size and geographic location upon wood use. Data from building plans and other records have been used to classify all FHA-inspected housing starts by major construction types known to affect wood use. Records from sample FHA Insuring Offices across the country are being analyzed to obtain wood-use information for each of these construction types.

First results from this study were reported in, "New houses—How many have wood construction?", which was later published in the November *Forest Products Journal*. Future publications will report the amount of wood framing, sheathing, flooring, siding and other wood materials used per house, and will show how house size, type of construction and geographic area affect the amounts of these materials used. Studies are also planned on wood use in factory-built houses and in single-family, detached houses built on-site but not insured by FHA, and on factors affecting substitution between wood products and other materials in house construction.

Wood Use in Nonresidential Construction

This study will provide information on variation in expenditures for selected wood materials and on the amounts of these materials used in the construction of elementary and secondary public schools. Building plans and construction costs data for 87 sample schools are being analyzed to determine the quantity of lumber, plywood, fiberboard and particleboard used in each, and the purposes for which these materials were used.

This study will be completed early in 1962. Subsequent studies will provide 1) reliable factors for use with current and projected school construction expenditure data as a basis for estimating the amount of selected wood materials consumed in building schools, and 2) information on factors affecting substitution between wood and other materials used in schools.

Wood Used by Manufacturers

Approximately 42,000 sample firms are being canvassed by mail to obtain information on the amount and kind of timber products used by manufacturing industries. To date 74 percent have returned a completed questionnaire. Information on wood use by sample nonrespondent firms is now being obtained by field interviews.

When completed, this study will provide the following information for all classes of manufacturing industries considered to use important quantities of wood in making, handling, or shipping their products:

1. The amount of lumber used (a) by species and grade, (b) per dollar value of products shipped, and (c) per employee.
2. The volume of bolts, veneer, and plywood used (a) by species, (b) per dollar value of products shipped, and (c) per employee.
3. The total volume of particleboard and hardboard used, the amount used per dollar value of products shipped, and the amount used per employee.
4. The distribution of the total quantity of each wood material into its various end uses.
5. Purchases of dimension stock, cut stock, pallets, containers and other wood products.

Reports on this study are expected to be available by the fall of 1962. At that time, a study of factors affecting substitution between wood and other materials used by manufacturing industries will be initiated.

H. R. Josephson, Director
Division of Forest Economics and Marketing Research
Forest Service, U. S. Department of Agriculture

THE WOOD RESEARCH PROGRAM at North Carolina State College has several mutually compatible objectives. The basic objective is the quest for knowledge about the properties and uses of wood, regardless of whether this search has practical implications at the time it is made. It is this kind of fundamental research that constitutes the reservoirs of knowledge out of which practical technological advances ultimately are fashioned. A second objective is to anticipate future needs of the wood-using industry and to correlate research to provide this information. A third objective is to develop the processes and techniques for new uses of wood, improve upon old uses, and develop techniques for converting wood into products which provide greater efficiency in terms of men and materials. The research activities of the laboratory are divided into six major subject matter divisions.

The Operations Analysis Division involves the application of the principles of mathematics, statistical analysis and industrial economics to the solution of managerial problems. Among the services performed are the development of rational procedures for quality control, yield analysis, procurement programming, market analysis, and product distribution.

Research in the Mechanical Processing Division is concerned with such unit operations as machining and drying of wood, including veneer cutting, sawing, surfacing, shaping, sanding, kiln drying, and veneer drying. Evaluation of cutting tools and equipment, determination of drying methods and schedules, equipment arrangement, and plant layout are among the services performed.

The Chemical Processing Division concerns itself with wood as a chemical material and with the properties and applications of chemicals used in association with wood. This includes investigation of carbonization, gluing, finishing, and preservation of wood. Research in the field of wood aggregates such as particleboard and fiberboard is included. Services include development of test methods, evaluation of adhesives, preservatives and finish materials, and conduct of performance tests.

The Wood Structure and Properties Division includes fundamental research in wood-moisture relationships, strength properties, electrical properties, and anatomical properties. Services performed include wood examination, wood testing, evaluation of wood as a structural material, and analysis of wood structures.

In the Tropical Woods Division various tropical species are evaluated to determine their use in reference to the requirements of the Southeastern wood-using industries. Services available in this division include evaluation of tropical woods for specific uses and development of processing techniques.

The Pulp and Paper Division is equipped to evaluate pulping and paper-making processes, and to conduct tests on pulp and paper products.

R. J. Preston, Dean
School of Forestry
North Carolina State College

ONE OF THE IMPORTANT PRODUCTS of our research program at the University of Minnesota is graduate student training. Not only is such training important and essential to provide qualified personnel for the forest products industries but it results in the accomplishment of a great deal of fundamental and applied research. It is a program which should be greatly expanded and which could be greatly expanded if additional funds for fellowships and facilities were available. Institutions with graduate training programs have a particularly heavy responsibility to train young men as well as pursue research in the forest products field.

Basic Research

A study of the discolored wood of aspen is underway to determine the effect of these discolorations on permeability, bleaching characteristics, and pulp quality. Identification of stands with high concentrations of discolored wood and the site factors associated with occurrence of such material will be studied in the future.

Permeability studies on aspen and other hardwoods are being made to obtain a better understanding of some of the factors affecting the penetration of pulping liquors into chips and preservatives into various wood products.

Earlier basic studies on the role of sulfur in the pulping reaction are being carried forward.

The variables involved in the marketing of wood on a weight basis are being studied with particular emphasis on the seasonal variation in moisture content, moisture content variations due to site factors, moisture content variations within the tree, and specific gravity variation within the tree and between sites.

Applied Research

Farm building design studies are being undertaken to determine whether more economcial and more satisfactory farm structures utilizing wood in some form can be produced. Located at the University's Rosemount Research Center are a number of structures which have resulted from this program. Others are presently on the drawing board or planned for the future.

MICROCLIMATE EFFECTS on plywood, laminated wood, particleboard, and wood finishes will be studied by USFPL on exposure fences in Madison, Wis.; Olympia, Wash.; Fresno, Calif.; and Saucier, Miss.

Long-term service tests on wood preservatives, involving various treating processes, preservatives, and species, are underway at four locations in Minnesota to determine the performance under service conditions. Included are fence posts, poles, siding, sash, and other products.

Replacement of paints by water-repellent preservatives containing pigments or stains is being intensively studied at the Rosemount Research Center. Studies which have run as long as from 8 to 10 years are yielding interesting and valuable information.

A new research project is being initiated to study the utilization of various wood products in new types of farm structures, which will provide complete environmental control. Involved presently are housing units for poultry, but livestock housing units may be considered in the future.

F. H. Kaufert, Director
School of Forestry
University of Minnesota

FOREST RESEARCH LABORATORY, Oregon State University, will continue project on structural use of Douglas-fir containing white speck.

A FUNDAMENTAL INVESTIGATION is underway at Oregon State University to determine the hereditary characteristics of wood of tree species common to the Northwest. Plantations of Douglas-fir and ponderosa pine are now under study. Objectives are to determine the degree to which genetic characters influence such properties as specific gravity, percentage of summerwood, rate of growth, fiber length, textural characteristics, and fibril angle.

A statistical analysis of the relationships among specific gravity, rate of growth, percentage of summerwood, seed source, and age of cambium at the time the wood was formed should be completed early in 1962.

A cooperative research effort on demand and supply in the plywood industry has several objectives:

1) To determine the equations that describe the relationship between plywood prices and the quantities supplied by the plywood industry.
2) To determine the equations that describe the relationship between prices received and quantities demanded by consumers of various plywood products.
3) To predict the market price which equates quantities demanded to quantities supplied for various plywood products.
4) To compare the predicted prices and quantities with actual market prices and quantities in order to test the predictive power of the system of equations estimated under (1) and (2).

This research project will apply econometric techniques to make a quantitative analysis of the economic forces within the plywood industry. This study should aid plywood industry people to learn more about demand and supply relationship and the factors which affect it. Such knowledge should aid them in analyzing economic problems facing their firms and the industry. Furthermore, such information should be useful in adjusting individual firm's production toward realistic goals and aid in establishing a realistic company pricing policy.

M. D. McKimmy
Associate Professor of Forest Products
Oregon State University

WOOD PRODUCTS RESEARCH in the Forestry Department at Iowa State University follows three general lines: 1) fundamental properties of wood and their relationship to specific products; 2) wood quality and growth relationships; and 3) research applied to certain local product problems.

A study is under way to determine the applicability of linear viscoelastic theory to wood. This research has immediate applications in gluing, drying, joint fabrication, timber design, pre-stressing, steam bending, and others. A second study, in cooperation with the U. S. Forest Products Laboratory, is designed to obtain a better understanding of the mechanism of failure in softwoods when they exhibit shelling along the surface of an annual ring. We are also conducting research to discover the variation in red pine specific gravity and fiber length associated with differences between stem-formed and crown-formed wood. If the results of the current analyses are positive, we expect to conduct further research into the physiological causes of differences between stem- and crown-formed wood. A study of the incidence of tension wood in soft maple has also been started.

Plans are being made to determine diffusion treating schedules for small pieces of 10 local hardwoods, and some attempt will be made to determine the effects of manure on the durability of these species. A study of local painting problems is also anticipated.

C. H. Stoltenberg, Head
Department of Forestry
Iowa State University

LOUISIANA STATE UNIVERSITY IN 1962 will be concerned primarily with problems of wood preservation and wood finishing since the climate of Louisiana is optimum for the development of decay organisms and wood destroying insects and leads to early breakdown of exterior finishes. The overall objective of the research program is to reduce the costs of maintenance of wooden structures and the finishes on those structures.

A study, in progress, of the moisture content of building structural members is expected to result in recommendations on the desired moisture content of lumber at the time it is incorporated in the building. The same study will pinpoint possible danger spots where treated lumber should be used. Other projects deal with the effect of preservative treatment on the service life of an exterior paint and an exterior varnish; the preservative treatment of wood for off-ground use; the permeability to water vapor of film-forming materials used in wood finishing; and the response of *Poria monticola* and *Polyporus versicolor* to chemicals used in plant pathogen control.

Another facet of the research program deals with investigations of fiber length, fiber wall thickness, and specific gravity of diffuse porous hardwoods. Cottonwood and willow have been partially investigated and work on other species is being contemplated.

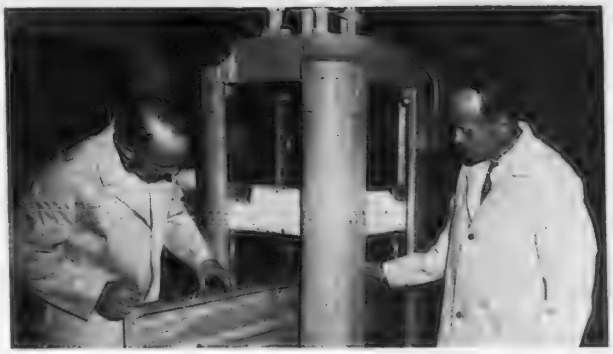
It appears that the big story in the wood-using industry in the South is one of diversification. Many segments of the industry are looking for new products and for ways to improve old products. Much thought is being given to more complete utilization of the raw material. Several plants are now producing finger-jointed and glued-laminated studs. Several others are investigating bark as a mulch and soil conditioner. Paper mills are using a larger volume of sawmill-produced chips each year, and more wood is being used in residences and business buildings now than was used 15 years ago.

W. C. Hopkins
Professor of Forestry
Louisiana State University

THE UNIVERSITY OF IDAHO is conducting research on wood quality and its relationship to environmental and genetic influences; specifically with ponderosa pine and Inland Douglas-fir, at present. Next year we plan to include also western red cedar. We are concerned with growth rate, percent summerwood and specific gravity as well as fiber and chemical properties.

We are studying the effect of decay caused by *Echinodontium tinctorium* in white fir on specific gravity, cellulose yield, and strength. This should help a manufacturer predict the quality and quantity of forest products from trees affected by this organism. Research comparing the bonding properties of summerwood and springwood in Inland Douglas-fir is also being conducted, with the hope of aiding the manufacturer in determining the cause of poor bonding of summerwood.

Work is being done on the properties of structural lumber laminated from Inland Empire species, with emphasis on the evaluation of modulus of elasticity, modulus of rupture, effect of scarf joints, and the effect of using 1-inch lumber. This data is used in designing beams to meet standards using less valuable material. Information on the comparison of strength and stiffness of dimension lumber, used both flat and on edge, is being determined for use in developing a nondestructive method of stress grading this material.



UNIVERSITY OF IDAHO, College of Forestry, will emphasize work on use of Inland Empire species for structural laminated beams.

Ernest Wohletz, Dean
College of Forestry
University of Idaho

THERE IS TANGIBLE EVIDENCE that industry has become aroused to the urgent need for attracting and training fresh recruits to fill its ranks, and 1962 promises to be a year of significant development in education for the forest products industries.

Focus of an educational program that has taken form since the Montreal meeting of FPRS in June 1960 is the NLMA–FPRS Joint Education Committee which has enlisted the cooperation of American Forest Products Industries, American Wood Preservers Institute, Douglas Fir Plywood Association, International Concatenated Order of Hoo-Hoo, National American Wholesale Lumber Association, National Retail Lumber Dealer Association, and the National Woodwork Manufacturers Association. The principal objective of this Committee is to stimulate increased interest in wood industry careers among high school students.

Career Packets are being distributed to Education Chairmen in each of the 14 Sections of FPRS. The goal set for 1961–1962 is that a pilot program shall be carried out in each Section—concentrating in one community (a town or possibly a county) an intensive program of talks and film showings in the high schools and before civic groups together with well-planned plant tours and effective newspaper, radio, and TV publicity.

Significant advances toward the strengthening of professional education in wood technology are also taking place. The Society of Wood Science and Technology, with financial support from the National Science Foundation, has undertaken a thorough study of undergraduate curricula and graduate programs in wood science and technology. The objective of this study is to strengthen the scientific base of professional education and to raise standards of course content and instruction.

Further evidence of an increasing educational ferment is the Visiting Scientist program of the Society of Wood Science and Technology, now in its second year. Financed through a grant from the National Science Foundation, this program has achieved notable success in stimulating interest among students in wood science and technology in various institutions. Through personal contact with members of the faculty and school administrators, this program also seeks to foster the development of quality educational programs in wood science and technology in our forestry schools and colleges.

F. F. Wangaard
Professor of Forest Products
Yale University

THE GENERAL DIRECTION of the forest products research program of the University of Florida has been improvement in wood utilization through better seasoning and wood-preservation practices. Current and recent studies have dealt with the accelerated seasoning of lumber and crossties through the use of covered air seasoning, forced-air drying, and high-temperature kiln drying.

Studies have shown that green 4/4 southern pine lumber can be dried to 19 percent moisture content in 14 days by employing fans that move air through the stacks at the rate of 300 feet per minute. Oak crossties can be forced-air dried in 3 to 4 months and be of higher quality than ties seasoned 10 to 12 months in the normal manner. Green gum crossties may be kiln dried ready for preservative treatment in 3 days, completely eliminating the loss due to decay that results from air seasoning in open stacks.

Wood-preservation tests in progress are concerned with the durability of wood treated by various preservatives and methods of treatment against decay and termite attack. Some tests date back over two decades.

Studies on use of low-grade hardwoods are basic to the development of the full timber growing capacity of the State of Florida. Much of this hardwood volume of 8 million acres is suitable for pulping. The pulpwood market, however, will not absorb the volumes available. In 1958, only 28 million cubic feet of a total annual growth of 94 million feet was cut. An increasingly heavier cut to remove low grade material from the woods is desirable. At the present time, only 7 percent of the hardwood volume is in trees classed as desirable growing stock. Research by well-trained wood scientists and technologists is essential to lead the way in developing ways to put this vast resource to work.

C. M. Kaufman, Director
School of Forestry
University of Florida

THE PHYSICAL AND MECHANICAL properties of glued construction were investigated to obtain basic information concerning the behavior of laminated wood under static load. A series of experiments was completed during the past year on the strength of butt joints in tension of various combinations of polyvinyl and urea resin adhesives. Infrared spectrophotometric techniques were used to determine if these adhesives have a combination effect. Data were analyzed to determine if stress relief occurs in this type of adhesive system. A study was also initiated to explore the thermal activity of secondary valence bonds by restricting the temperatures of the set period. Another phase of this project recently activated deals with the theory of adhesion and has two objectives: 1) the examination of the interface when contaminated by some wood modifying chemical, and 2) the determination of stress levels in the wood-glue layer in adhesive joints.

Wood-Moisture

A portion of this project was concerned with the equilibrium moisture content of flakeboard and is discussed in the study described below. A second phase dealing with the effect of moisture on the development of stress in tension and concomitant strain is nearing completion. Results to date indicate that preliminary stress and strain patterns developed under two moisture regimes and three load levels show wood to have elastic visco-plastic and permanent deformation levels which are dependent on the variables imposed. This study will be continued in 1962.

Particleboard

The physical and mechanical properties of wood particleboard are being investigated to obtain information concerning the effect of such factors as chip geometry, resin content and density on the physical and mechanical properties of particleboard made from hardwood species commonly found in Pennsylvania; and to investigate the production of particleboard of satisfactory physical and mechanical properties using reduced amounts of available binders or new types of binders. During the past year data derived from ultraviolet photomicrography have been analyzed and measurements of glue line thickness have been completed. The effect of particle geometry, resin content and equilibrium moisture content on the dimensional stability of the board have been investigated. A study of the photomicrographs confirmed the fact that a continuous glue line does exist. Results to date also show that flakeboard does not follow the conventional dimensional change curve. The initial swell curve exhibits a sharp departure at equilibrium moisture contents of approximately 20 percent. This occurs regardless of flake geometry or resin content. This study will be continued in 1962 to determine: 1) the adhesive mechanism regarding moisture variation relationships and wood-glue interface systems, and 2) the mobility of resin and the effect of exposure systems on physical and mechanical properties. Other factors influencing the quality of the board may be added.

A project on growth-quality relations has as its objective the study of changes in stem anatomy in growing seedlings caused by different nutrient agencies. Preliminary results indicate that anatomical differences can be attributed to the nutrients supplied to the growing plant. Efforts are being made to initiate a study of hybrid poplars.

Woodpeckers, Marketing

The prevention of woodpecker damage to wooden utility poles is being investigated. The project will be continued in 1962 with major emphasis on the biology of the bird.

The marketing of lumber in Pennsylvania is being studied 1) to determine and analyze the structure and organization of markets for lumber produced by sawmills in Pennsylvania and 2) to provide information on ways and means of remedying such marketing inefficiencies as may be uncovered during the course of the study. Results to date show that the most effective channels of distribution for lumber produced by all sawmills, regardless of size, were the manufacturing and wholesale outlets.

N. A. Norton, Head
Department of Wood Utilization
The Pennsylvania State University

A STUDY IS UNDER WAY at Michigan State University on variables connected with the press cycle in manufacture of particleboard. This is aimed at measuring the effect of pressure and temperature and their reaction with such raw material variables as moisture content and geometry of chips. The primary interest is how the combinations of variables affect the density distribution within a board.

Seasoning, Plywood, Preservatives, Packaging

In the seasoning field, efforts will be directed to determination of drying stresses through measurement of overall shrinkage rates of boards and moisture gradients. Surface stresses are being estimated by use of a thermal stress analogy. This work, if successful, would simplify measurement of effect of a new kiln schedule.

Considerable work has been done in designing and testing of plywood truss beams. A general study of the strength of plywood for gussets and webs of beams is contemplated. These wood beams will have a big impact on home building.

Work is continuing on the strength properties of combination metal-wood laminated members. Adaption of nondestructive testing to particle boards will be investigated.

One study in wood preservatives to be extended involves the behavior of elm in pressure treatment and another use of dry chemicals in the double diffusion treatment of posts. Both studies may prove of value commercially; the first for utilizing elm killed by disease and utilizing species with few outlets, the second for applications in ground-line pole treatment and for on-the-farm treatment of small lots of posts.

Projects underway in packaging research include control of physical damage to packaged merchandise and to packages including methods of measuring shocks, nature of fragility of articles prone to damage, fundamentals of properties of packaging materials and containers which make them effective in protecting goods against shock.

A study of the folding resistance of scored bending board as a factor in high speed filling and cartoning operations is contemplated. This includes development of a score testing device that will reproduce machine bending conditions, a study of variability in folding resistance, and performance of cartons with scores of known folding resistance on filling machines operating at different speeds.

Another study in the packaging field is concerned with the physical properties of importance in the use of flexible materials and combinations thereof on packaging machines. Another involves research into methods used for sealing flexible and rigid materials, study of ultrasonic sealing methods, and use of new sources of energy for sealing purposes. Other studies include the use of moisture vapor permeability rates in design of packages for definite shelf life and gas permeability of packaging materials and their effect on shelf life.

E. A. Behr, Associate Professor
Department of Forest Products
Michigan State University

FOREST PRODUCTS RESEARCH at Oregon State University places special emphasis on timber mechanics and use of wood for structural purposes. Tests are being made of screws, staples, and bolts for fastening wood, and on improved segregation of lumber by nondestructive tests. Reports on the fastening work should be available in 1962.

Hardness-strength relationships are under investigation, as is the relationship of stiffness to bending strength of seasoned and unseasoned dimension lumber pretested flat but broken on edge. A current study of glueline shear strength of white-pocket Douglas-fir may lead to the grading and inclusion of such material in laminated structural members.

Mechanical properties of western softwoods, especially West Coast hemlock, will be explored. The work will include use of dimension lumber in structures and laminated members, nondestructive testing, and segregation of structural wood products for strength.

Utilization

Two reports on particleboard will be available in the coming year. One reports on dimensional changes of commercially produced boards; the other will cover several methods of improving dimensional stability. A third study will investigate the effect of conditions of resin application on gluebond formation.

Pretreatment of Douglas-fir to improve its pulping characteristics for both acid and alkali cooking is being studied. Similar work also shows promise for aqueous pulping of red alder for corrugating medium with recovery of furfural. Fundamental studies on lignin will supplement the pulping research.

Most research on bark utilization is concentrated on its use as a source of chemicals; however, studies on molded products and soil amendments are also underway. Work is also being conducted on anti-oxidants, bactericides, and pesticides.

FOREST RESEARCH LABORATORY at Oregon State University will continue to search for improved seasoning methods. This charge of red alder was dried in less than 80 hours without excessive degrade.

Processing, Seasoning, and Preservation

The recent increase in the use of true firs and West Coast hemlock for plywood has led to a study of the compression characteristics of these woods during hot pressing and an investigation on the influence of glueline on preservative penetration.

Seasoning research is aimed at developing information on local species that operators may use to improve their kiln schedules. Oregon maple will be studied in the coming year, and the high-temperature drying of softwoods will be investigated.

Service tests of preservative treatments begun 10 years ago are now producing significant information. Tests include railroad ties, hop poles, greenhouse benches, fire-retardant treatments, and marine exposure.

L. D. Espenas
Forest Research Laboratory
Oregon State University

OUR RESEARCH PROGRAM in the Wood Products Engineering Department at the State University College of Forestry at Syracuse University for 1962 will center as much as possible on the basic aspects of wood science. Correlated will be several attempts to contribute to the engineering of wood products. Among the former projects are planned further work in wood physics, including effect of moisture and temperature on electrical conductivity and moisture movement in wood. Adhesion, basic to finishing, as well as to assembled wood, will receive attention.

Wood Structure

In anatomy and structure of wood, the cell wall and the minute structure of the cell will be examined further. Vestured pitting and its relation to the warty membrane, as well as changes in the ultra structure of wood cells during heartwood formation represent specific areas of interest at this time. Compression wood formation as affected by growing conditions requires a more quantitative treatment if the forest manager is to have a sharper tool in quality selection of growing trees. A contribution to this problem is expected, especially as it applies to degree of lean and to growth rate.

An interesting analysis of the effects of position and size of various defects in laminated beams should contribute to better design in wood structures of this type. Completion of tests involving nearly a thousand beams of white oak and Douglas-fir is planned. Several Central American plantation-grown hardwood species together with a natural-grown softwood species from that region are being analyzed for their commercial possibilities. Included are determinations of their mechanical, durability, machinability and pertinent properties. These should be of interest in planning future planting programs on some Central American forest lands.

Fire-Resistant Particleboard

Improving fire resistance of wood is a potent problem in its structural uses. One study will be concerned with fire-retardant treatments of particleboard.

Fundamental Cutting Studies

Further work will be done on chip formation and the factors affecting it in machining of wood. A better understanding of the physics of the cutting action is essential to progress in methods of getting the exact wood surface desired for a given purpose with the least amount of effort.

If the use of wood is to continue on a competitive basis with other materials, both the engineering and the science phases of wood technology must be explored and developed to the limit. Since a university is ideally suited to pursuit of fundamental research, it is planned to emphasize these aspects. The engineering side will not be forgotten, however, and research will continue in this area.

Eric A. Anderson, Chairman
Wood Products Engineering

IT WOULD ALMOST SEEM that any prediction of things to come from the Pacific Northwest Section should be in the traditional style of the frontier west, where the "good guys", brandishing exotic new products, cause the traditionalist "bad guys" to fall by the wayside. But this is only an imaginative illusion. In a way the situation is something reminiscent of frontier days, for in the market place it has been and is a battle for survival, where the future is dependent on combined efforts and cooperation.

The demands for literal survival in our industry depend more and more on improving what we are doing now; everything we are doing, from transportation of chips to unitized packaging of lumber, from sawdust to piling, from the janitor to the executive committee. With this in mind, we are lowering the ceiling of our "blue sky."

One manner in which information can be developed and presented to a diverse group of interests is through panel discussions of knowingly controversial subject matter. This is one approach we plan to use in 1962. Two topics already scheduled for presentation in 1962 include the question "what is needed in plywood manufacturing in the way of glues and machinery" and "laboratory specification criteria as opposed to end-use requirements." Both of these topics promise to bring out information and ideas vital to the industry. Still another topic that promises much of value is the one of material combinations, scheduled for presentation in 1962. These topics will be supplemented with such topics as plywood overlays, laminating, finishing, particleboard and hardboard, and others pertinent to the Section's industry.

Section programs will be reduced from our normal 24 technical papers during the year by the cancellation of our Spring meeting in May. It is hoped that this will make it possible for the Section to participate more fully in the National Meeting in Spokane where our neighbors in the Society will be lending their own "blue sky approach" for the entire membership of the Society.

In summary, we want to know more about the launching pad before we get too concerned about the trajectory of our rocket. In so doing we would hope that a genuine contribution can be made to the need for basic information about our products and the processes by which they are born.

Don Burnet, Acting Chairman
Pacific Northwest Section
Forest Products Research Society

THE ECONOMIC CLIMATE of the forest products industry in Canada and the United States during 1962 will continue about the same as it has during the past two years. The production of saw timber is likely to remain fairly constant while some increase in pulpwood cutting is likely. An increase in the production of pulp chips from sawmill residues can be expected.

The increasing efforts of loggers and equipment manufacturers to reduce logging costs by the use of more efficient methods and equipment will be continued and more research is likely to be undertaken to resolve the basic problems affecting logging production in North America.

1962 will probably see the continued refinement and development of the types of equipment presently in use, some of which are only now in the prototype stage.

This will involve greater use of rubber-tired tractors for skidding in almost all localities where through specific applications their cost reducing potential can be achieved. Next year will also see further experimentation and development of self-propelled harvesting units that fell, delimb, debark, buck and pile into the desired log or bolt lengths in the woods. It is believed that in areas where these units can be readily adapted, their use if developed to sufficient capacity, will have significant effects on woods production, especially with respect to pulpwood logging.

It can be predicted that the use of hydraulics in 1962 in logging equipment of all types will increase with likely reductions in manpower requirements being achieved. The forthcoming year will also see a greater interest in the quality evaluation of the primary products of the forest. Log and tree evaluation techniques and methods which have been and are being developed both in Canada and the United States, will see wider application in 1962 than ever before in North America.

In summary, it can be said that in 1962 the economic pressures on the industry in both Canada and the United States will necessitate the continued development of more efficient harvesting methods and techniques which, on the whole, will lead to improved utilization practices and more economic operations.

J. A. Doyle, Chairman
Timber Production Division
Forest Products Research Society

PRICES FOR LUMBER were generally lower in 1961 than in the previous year, notwithstanding an improvement in housing construction. In order to survive during this economical pressure, the sawmills have concentrated their efforts on improvements of equipment, to save on the cost of labor and minimize waste. It seems that this trend will continue during 1962. Since the price of equipment has become more acceptable to an average-size operation, we will see in the next year many more riderless carriages, automatic edger shifters and electric resaw setworks installed in plants, with a corresponding saving in labor and an increase in the quality of the product.

A number of systems of automatic sorting chains have been developed, but all of them have a limited capacity of sorts and the prices are so high that only operations with a very large production justify this expense. Many firms are searching for a more reasonable solution, and let's hope that the next year will see the result of this research.

There is a strong trend in the industry to utilize the sawmill waste and shavings in the production of particle and flake boards, fertilizers, chemicals, etc., as well as up-grading lumber by end- and edge-gluing. The market for these products is still limited and the capital required for the development is considerable. Next year we should see further work done in that direction, but the pace of the progress will be slow.

The year 1962 in the sawmill industry will bring no revolutionary measures but we will see a continuation of a trend in improving machinery automation and utilization—a trend which started in the postwar years.

Paul Heller, Chairman
Mechanical Conversion Division
Forest Products Research Society

REVOLUTIONARY NEW DEVELOPMENTS in gluing wood may be uncommon, but the many significant steps now being taken illustrate the steady progress in gluing for better utilization of wood. Newer types of adhesives are being actively explored for new gluing techniques and products. Rubber-base systems for use in continuous roller press operations are used widely for nonstructural assemblies such as flush doors and certain building panels. Epoxy resin systems are of great interest for composites of wood with other materials and where their potential gap-filling and high solids characteristics are of importance, but so far have had no extensive actual use in wood. Improvements in vinyl emulsions to achieve greater thermosetting characteristics are reported in laboratories.

The softwood plywood industry continues to grow and develop new markets for its products. One recent promotion is plywood for agricultural applications in modern, large farm operations. One estimate for sale of plywood to farmers ran as high as 3 billion square feet on ⅜-inch basis by 1965. This would represent nearly half of all softwood plywood production in 1958.

Prepressing of softwood plywood at shop temperatures has been studied recently to improve production of hot-pressed plywood for both interior and exterior use. Advantages suggested include economies because of reduced veneer slippage and misalinement, better transfer of adhesive from coated to uncoated veneers, and reduction of edge dryout with wrinkled veneers.

Production of glued structural components of plywood to lumber framing for building wall and floor panels, folded plate and barrel vault roofs continues to expand slowly as production facilities and markets are established.

There seems to be some increase in a "do-it-yourself" preparation of glue formulations directly from raw materials by some West Coast plywood mills, limited mainly to nonresin glues.

Finger-jointing of lumber, as a means of utilizing short lengths of good lumber, continues to grow. This involves attempts to produce well-machined joints consistently with thinner tipped fingers that reduce stress concentrations and end-grain gluing, as well as improved gluing techniques and automated production equipment.

BORDEN CHEMICAL'S new laboratory houses a research-sized plywood layup plant, a battery of presses, a pilot plant, and adhesive equipment for research on plywood, particleboard, and hardboard.

Gluing preservative-treated lumber for structural laminates appears to be growing as these laminates are used for outdoor conditions. Much interest in the gluing of lumber treated with fire retardants has developed. Research on reported interferences in gluing such material with resorcinol-type glues is underway.

One firm recently announced it is producing high-quality hardwood plywood panels with surfaces protected by clear thermoplastic films laminated to the plywood surfaces by a special high-speed rotary press laminating process. Such panels are proposed for vertical surfaces in heavy-duty, high-traffic areas in public buildings. A completely redesigned "nailless" wood pallet was announced in which urea-resin glues are used to replace nails.

A number of prominent adhesive and chemical manufacturers, not now in the wood glue field, have been actively researching potential markets for new wood adhesives. These firms, with their extensive backgrounds in related polymer and adhesive areas, should be able to contribute much to expanding utilization of wood through more effective and practical gluing processes. Their cooperation should be encouraged by all present wood-using industries.

R. F. Blomquist, Chairman
Glues and Gluing Processes Division
Forest Products Research Society

RESEARCH IN ANATOMY AND FUNDAMENTAL properties of wood is moving along many paths. Electron and X-ray microscopy, new developments in phase and infrared microscopy are providing additional tools for learning more than ever before about the anatomy of wood and factors that affect it, such as growth conditions, treatment, and fungal action.

Increased awareness of the fact that wood quality starts in the forest is leading to intensive study of growth-quality relationships. How does density, or fibril angle, or percentage of summerwood of a tree species depend on geographic location, site, elevation, rainfall, or other growth features? We have some answers for some species already and will be finding more during 1962.

The urgent need of the wood industry for means of nondestructive evaluation of wood strength, stiffness, and moisture content is reflected in research aimed at providing a basis on which to develop those means. Investigations of the response of wood to sonic vibration have already shown a good relationship between the fundamental frequency of the wood and its stiffness. The manner in which the wood damps these vibrations may also tell us much about its strength. Ultrasonic vibration techniques have possibilities for detecting voids in wood and in glue bonds. Developments in nuclear physics have provided a new tool in the form of increased knowledge of the behavior of radioactive isotopes and the radiation emitted from them. Techniques of measuring backscatter and transmission of such radiation, in combination with other techniques, may yield a commercially practicable method of continuous detection of wood density and moisture content.

Basic studies of the time-related mechanical behavior of wood are giving us new and better answers to such questions as why does wood behave differently under impact loading than under static loading, how is the mechanical behavior of wood related to its structure, and what factors are most significant for predicting the mechanical behavior of wood under any particular loading conditions.

Demand for information on the anatomy and fundamental properties of wood should increase significantly during 1962. The industry is becoming aware of its possibilities and has available the engineering and instrumentation to put basic concepts to practical use. The information will not be forthcoming as rapidly as many would have it, but 1962 will see some of the answers.

R. L. Youngs, Chairman
Anatomy and Fundamental Properties
Forest Products Research Society

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Articles cover: whole wood fiber manufacture; lignin chemistry; processing pine gum; paper and plastic overlays for veneer and plywood; integrated utilization; trends in logging; pulpwood logging developments in eastern Canada; building codes in postwar wood construction; engineering problems in prefabricated homes; postwar packaging field; functional furniture; postwar woodworking glues; metal to wood bonding; high frequency in woodworking; wood finishing; the use of car treated lumber; fence posts; an untapped market for the wood preserver; acid-proofing of wood; the artificial seasoning of wood in vapor of organic chemicals; kiln design; tungsten carbide developments; and tight cooperage plywood.

1948—Vol. II—UTILIZATION, FIBER PRODUCTS, BARKING, FINISHES, MACHINERY, R. F. HEATING. 50 papers, 500 pp.

Articles cover: economics of wood-waste utilization; losses in Redwood logging; small log gang sawmill; utilization of low-grade hardwood lumber; wood-distillation industry; sawdust carbonization; animal feeds from wood residue; small wood briquetting machine; special machines for utilization of waste slabs for glued core stock; interior trim from wood waste; wood-fiber production with revolving disk mills; effect of some manufacturing variables on the properties of fiberboard prepared from milled Douglas-Fir; small hydraulic log barker; mechanical methods of bark removal; studies on the chemical composition of bark and its utilization for structural boards; research in industry laboratories; history of furniture finishes; finishes resistant to alcohols and acids; low-bake synthetic finishes; simple testing methods for finishers; planning floor space for woodworking equipment; maintenance and operating practice for tungsten carbide tools.

1949—Vol. III—RAW MATERIAL, FURNITURE, PLYWOOD, UTILIZATION, GLUES, SEASONING. 55 papers, 607 pp.

Articles cover: more wood per acre; integrated wood utilization at Crossett; harvesting sawlogs; portable wood chippers; wood fibers from veneer waste; small permanent-type sawmills in better forest utilizatiton; pulpwood handling in the Lake States; tropical wood research for the furniture industry; effect of plywood glue lines on the accuracy of moisture-meter indications; No. 3 common Northern hardwood lumber for mechanized processing into glued products; cut stock from western softwoods; assembly material in furniture manufacture; supplementing wood with metal in furniture manufacturing; extending hot press urea resin with wheat and rye flour; furniture finishes; lumber core panels; rotary veneer cutting; molding plywood; insert-point circular headsaws; ills besetting the furniture industry; utilization of Redwood bark; utilization of waste sulfite liquor in concrete; semichemical pulping; dry-formed boards bonded with resins; wood, plywood and hardboard; compreg-resin-treated densified wood; wood preservatives; wood boring beetles; ignition temperatures of fireproofed wood, untreated sound wood, and untreated decayed wood; wood waste disposal and air pollution control in the Los Angeles area; pulp mill pollution; chemical composition of Ponderosa and Sugar Pine barks; lumber recovery from Douglas-Fir logs in British Columbia; resin adhesives; development of working stresses for stress-grade lumber; design and performance of laminated wood trusses, glued laminated wood, glued laminated Wej-weld frames; radio frequency heating.

1950—Vol. IV—MILLING, CONTAINERS, QUALITY CONTROL, PLYWOOD. 45 papers, 506 pp.

Articles cover: quality of second growth Douglas Fir; grading problems; quality control and the improved seasoning processes of the Redwood industry; saw teeth in action; lumber research to meet modern competition; hardwood log grading; recent developments in wirebound containers; method of utilizing and fabricating waste lumber; tests of strapped and lightweight lettuce crates; recent developments in containers; papermaking fibrous raw materials; utilization of low-grade hardwoods and softwoods; relation between wood and pulp properties; power vs. hand falling and bucking in logging operations; handling pulpwood; quality control in sawmill operations; hardwood plywood quality control; quality control in furniture production; defect detection equpiment non-destructive testing.

1951—Vol. V—MILLING, MACHINING, PRESERVATION, UTILIZATION, GLUES, KILN DRYING. 51 papers, 400 pp.

Articles cover: circular sawmills in the Tennessee Valley region; quality control in lumber manufacture, gangsaws in the manufacture of southern pine lumber; tropical hardwood production, logging and military equipment availability; defense and the availability of woodworking equipment; the importance of wood in the mobilization program; mobilization requirements for technical men in the woodworking industry; lumber conservation in military procurement and container design; military requirements for wood in packaging; wood requirements for specialized military uses; the place of small business in the military procurement program; marine laminating; selecting White Oak for bending lumber; machinability studies; carbide cutting tools in the wood industry; carbides; fire retardant treated lumber; wood preservation with particular reference to creosote; what the furniture industry expects from college-trained men; the scope and objectives of college training; graduate training in forest products technology.

Accelerated Weathering of Red Oak

Treated With Various Preservatives Used to Treat Crossties[1]

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This report contains results of an experiment made at the U. S. Forest Products Laboratory to determine if a laboratory method of accelerated weathering would indicate differences in surface checking of treated red oak specimens after the wood had been treated with various oil-type preservatives.

IT IS GENERALLY BELIEVED that creosote and oil borne preservative solutions are effective in retarding surface checks and end splits in weathering railway crossties. The bleeding of the preservative is presumed to create a film having vapor barrier characteristics, and this film limits moisture content changes. Studies to determine significant performance differences among creosote, creosote solutions, and pentachlorophenol solutions in terms of railway crosstie replacement would be costly and lengthy.

The present experiment consisted of specimens of northern red oak treated with various creosote and pentachlorophenol solutions and exposed to varying conditions that created moisture regain and drying gradients. Untreated specimens were used as controls.

Design of the Experiment

Treating Preservatives: Specimens of northern red oak were treated with the following preservative solutions:

Treatment No.	Preservative solution
1	Controls—untreated
2	Creosote-petroleum (50–50 percent)
3	Creosote-coal tar (70–30 percent)
4	Creosote (100 percent)
5	Penta[3] (2.5 percent)—Medium gas oil
6	Penta (2.5 percent)—Residual fuel oil
7	Penta (2.5 percent)—Heavy slurry oil
8	Penta (2.5 percent)—Heavy cycle oil

Species, Specimen Size, and Specimen Preparation: The species selected for this study was commercial northern red oak. The specimens were nominally 2 by 8 inches in cross section and 24 inches long. The 2- by 8-inch stock from which the specimens were cut was flat sawn and all heartwood. To provide specimens free of surface checks for treatment and exposure, green rough-sawn boards were purchased and kiln dried green from the saw. To provide the needed number of specimens free of surface checks at a moisture content of about 20 percent for treatment with the preservatives, it was necessary to procure three lots of 8-foot boards. These boards were kiln dried from the green condi-

[1] The work here reported was done in cooperation with the Dow Chemical Co., Midland, Mich. Presented at the 1961 Annual Meeting of the Forest Products Research Society, Louisville, Ky., Session 2 (Division 7, Treatments and Coatings), June 19, 1961.

[2] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

[3] The four pentachlorophenol solutions were furnished by the Chapman Chemical Company, Memphis, Tenn. The firm reported that each solution contained 2.5 percent of pentachlorophenol. The suppliers and the properties of the petroleum oils they furnished are tabulated in Table 1. The coal-tar creosote and creosote solutions were furnished by the Forest Products Laboratory, and an analysis of their properties is given in Table 2. The 70–30 creosote-coal-tar solution was purchased in August 1956 from another commercial firm under AWPA Standard P2.

[4] Torgeson, O. W. 1957. Schedules for the kiln drying of wood. U.S. Forest Products Laboratory Report No. 1791. (Revised).

[5] 1954. Use of kiln samples in operating a lumber dry kiln. U. S. Forest Products Laboratory Report No. 1607. (Revised).

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Fig. 1.—Spray chamber showing specimen rack and spray head arrangement.

Fig. 2.—Infrared lamp bank for heating surfaces of specimens.

tion according to schedule T3-D1 for red oak.[4] The kiln-sample technique[5] was used to determine the average moisture content of the lot during the drying process. The boards were inspected for surface checking at an average moisture content of about 40 percent. Surface-check-free areas were marked on the boards for later inspection and acceptance as specimens. The first two kiln charges did not produce enough clear specimens free of surface checks for the experiment. A third lot was kiln dried by the same schedule, but the green rough-sawn boards were jointed on both sides to produce surfaced faces. Little surface checking occurred during kiln drying of these surfaced boards. Half the specimens needed in the experiment were obtained from the rough-sawn boards, and half were obtained from the "blanked" or surfaced boards.

When kiln dried to about 20 percent, the boards were removed from the kiln, and the 2- by 8- by 24-inch specimens were cut. A 1-inch moisture content section was cut from the adjacent ends of each specimen. These data provided a means of computing the calculated oven-dry weight of each specimen. The specimens were all stored in a room maintained at 80° F. and 90 percent relative humidity until needed for the preservative treatments. The control or untreated specimens were end coated with roofing cement when taken out of the humidity room. The others were end coated with the same material after the preservative treatments were made.

A few of the dried boards produced three specimens for the experiment. Fifty-four rough boards and 55 dressed boards were used. No attempt was made at the mill to identify the boards as to the tree from which they were sawn. As the boards became mixed during handling at the sawmill and at the Laboratory, the influence of tree effects is believed to be generally scattered throughout the experimental material. The boards were numbered and then cut into specimens. The specimens were also numbered, and they were randomly assigned to the eight treatments, one of which was the untreated controls, using a table of random numbers.

Experimental Design: Two hundred specimens were prepared, and 25 were randomly assigned to each of the 8 treatments. Five specimens of each of the 8 treatments were randomly assigned to an outdoor-exposure test, and the remaining 20 specimens of each treatment group were randomly assigned to cycling groups. Because of limitations of equipment, all of the 160 specimens could not be handled at one time through the exposure cycle. Ten cycle groups were therefore made up of 16 specimens each. Each preservative treatment and the controls were represented in each cycle group by 2 specimens. Ten replications of the cycle-exposure test were thus available to average out any differences that might exist in the operation of the equipment used for the accelerated weathering exposure conditions. The assignment of specimens to treatments, to cycle-exposure groups, and to outdoor-exposure groups was done through use of random numbers.

The experiment was designed so that the analysis of variance could be used to test the significance of surface-check-rating means of the treatment groups. Each treatment was represented by 20 specimens in the cycle-exposure tests, and the specimens were allocated irrespective of whether they were rough or dressed. As a result of this random allocation of specimens to treatments, a disproportionality was created in the number of rough and dressed specimens in the various treatment groups. This lack of proportionality between rough and dressed specimens in the treatment groups made the analysis between the treatment groups for either the rough or dressed classification less reliable than

the analysis among treatment groups with the rough and dressed classifications pooled. The analysis will show, however, that the treatment effects in both the rough and dressed specimens are substantially the same as for the overall analysis.

Cycle Exposure Conditions: To accelerate the influence of changing-outdoor-climatic conditions on the development of surface checking, it was necessary to alternate the moisture content gradient between sorption and desorption phases. Any number of variations in temperature, relative humidity, water spray, and duration of exposure to create a moisture-content-regain gradient and a drying gradient could have been established as a cyclic exposure test procedure. The following exposure conditions were used in this test:

Step	Exposure	Time	Cumulated time
1	Water spray	1 day	1 day
2	Low relative humidity—high temperature	1 week	8 days
3	High relative humidity—low temperature	2 weeks	22 days
4	Infrared heating	6 hours	22¼ days
5	Low relative humidity—high temperature	18 hours	23 days

One of the larger Laboratory dry kilns was operated as a "wet room" for the storage of pole stubs. The pole sections were kept wet by means of a water spray. A rack was built and installed in this kiln to hold the 16 specimens, consisting of a single-cycle group. A special water line with a series of water spray heads was installed to provide the water-spray-exposure step of the cycle. The rack designed to hold these specimens provided a slight pitch to the specimens, which were resting on one end. The spray heads were adjusted so that the surfaces of all 16 specimens were wetted. The flat-sawn specimens were placed on the rack so that the face toward the bark was exposed to direct wetting from the spray heads. Figure 1 shows the arrangement of the spray rack, the water spray lines, and atomizing nozzles or spray heads inside the dry kiln. When the cycles were repeated, the placement of the specimens on the spray rack was random, so it was not likely that any specimen was placed in the same position in respect to the spray heads. A programmed order of placement on the spray rack was not deemed necessary.

Step 2 of the cycle-exposure test condition was conducted in a small drying chamber. The dry-bulb temperature was thermostatically controlled at 180° F. and the wet-bulb temperature thermostatically maintained at 123° F. to produce a relative humidity of about 20 percent. The specimens when taken out of the spray chamber were allowed to stand for a few minutes so as to "drip dry." After weighing and inspection, the specimens then were placed in the drying chamber on stickers. Forced-air circulation in the drying chamber provided good air movement of the high-temperature, low-relative-humidity air through the layers of specimens.

After the specimens were exposed 1 week to these rather drastic drying conditions, step 3 began. They were weighed, inspected, and then placed in another drying chamber operating at 140° F. dry-bulb temperature and 136° F. wet-bulb temperature, which produced a relative humidity of about 90 percent. As in the other drying chamber, the wet- and dry-bulb temperatures were thermostatically controlled. The wet-bulb wicks had to be changed quite often in both drying chambers, because the vapors from the treated specimens caused fouling of the wicks and errors in the wet-bulb temperature control. The specimens were placed on stickers in the drying chamber used for this step of the cycle exposure test.

Step 4 of the cycle exposure test consisted of 6 hours of exposure to infrared radiation to produce a drastic surface drying condition. The specimens were again weighed, inspected, and then placed on a rack, as shown in Figure 2. The bank of infrared lamps was positioned so that the distance between the lamps and the specimens was 36 inches. The specimens were placed on the rack with the side toward the bark exposed to infrared radiation. For step 5 of the exposure cycle, the specimens were again weighed, inspected, and then placed in the drying chamber operating at 180° F. and 20 percent relative humidity. After an additional 18 hours of drying, the cycle was completed, and the final weights and inspection data were obtained.

Each of the 10 cycle groups was subjected to this cyclic exposure test, which was repeated 6 times.

Measuring Technique for Surface Checking: A number of different methods may be used to determine the influence of the cycle-exposure condi-

Table 1.—SUPPLIERS AND PROPERTIES OF PETROLEUM OILS IN PENTACHLOROPHENOL SOLUTIONS

Property	Aromatic HB oil [1]	24 plus burner oil [2]	Decant oil C [3]	101E oil [4]
API gravity at 60° F.	16.1	14.7	4.5	7.2
Weight per gallon at 60° F., pounds	7.98	8.061	8.67	8.5
Specific gravity 60/60	0.9587	0.9679	1.0404	1.0202
Flash point [5], °F.	225	200	260	240
Viscosity at 100° F. [6], seconds	39	177.6	177.8	72.4
Viscosity at 210° F. [6], seconds	30.4	47.5	42	35.5
Pour point, °F.	Below 0	Below 5	+70	+50
Color	Brown	Blackish brown	Brown	Greenish brown
Penta solvency at 75° F., percent	17	----	21	----
B. S. & W. [7], percent	.2	----	1	----
ASTM distillation				
Initial pulping point, °F.	490	434	480	530
10 percent, °F.	510	499	580	586
20 percent, °F.	516	525	630	606
30 percent, °F.	518	553	670	622
40 percent, °F.	522	590	686	642
50 percent, °F.	524	652	696	658
60 percent, °F.	528	706	700	672
70 percent, °F.	532	746	702 [8]	686
80 percent, °F.	542	760	------	702
90 percent, °F.	558	Cracked	----	716 [9]
End point, °F.	590	------	------	716
Recovery, percent	97	------	------	88

[1] Supplied by Enjay Co.
[2] Supplied by Standard Oil Company of Texas.
[3] Supplied by Cities Service Refining Co.
[4] Supplied by American Oil Co.
[5] Pensky-Martens closed tester, ASTM Standard D-93.
[6] Saybolt Universal, ASTM Standard D-88.
[7] Basic sludge and water.
[8] At 64 percent.
[9] At 88 percent.

tions on surface checking. The total lineal inches of surface checks for each of the 24-inch specimens could have been used, but the method fails to assess the severity of wide and deep surface checks. For example, a specimen could have a very few inches of checks, but they might be quite wide and deep. From the standpoint of this experiment, this might be more serious than if the specimen had a much greater total inches of surface checks that are narrow and shallow. A descriptive surface-check grading system could have been used, but conversion of such a system into a numerical rating that would have been suitable for statistical analysis was not considered feasible.

It was therefore decided to use a numerical rating system that provided data that could be statistically analyzed. After each step of the cyclic exposure test, the total length of surface checks on the face toward the bark was measured and recorded to the nearest half inch. The average width of the checks and the average depth of the checks were estimated. Surface check depths were estimated by using a thin feeler gage. A severity rating factor was applied to the total length of surface checks measured in accordance with the following classification:

Total length of surface checks Inches	Severity rating factor
0	0
0 to 2.0	1
2.25 to 6.0	2
6.25 to 18.0	3
18.25 to 48.0	4
48.25 or more	5

A numerical rating factor based on the estimated average width and depth of the surface checks was applied, using the following system:

	Numerical rating factor		
Average width of checks Inches	Checks less than 0.05 inch deep	Checks from 0.05 to 0.25 inch deep	Checks more than 0.25 inch deep
0 to 0.01	1	2	3
0.01 to 0.10	2	3	4
0.10 or more	3	4	4

The severity rating factor was multiplied by the numerical rating factor to provide a surface-check rating of the specimen. For example, if the total length of surface checks was 5.0 inches, the severity rating would be 2. If the average width was more than 0.01 inch but less than 0.10 inch and the average depth was 0.05 to 0.25 inch, the numerical rating was 3. The surface-check rating was then $2 \times 3 = 6$. The maximum surface-check rating that could be assessed against any specimen would be $5 \times 4 = 20$.

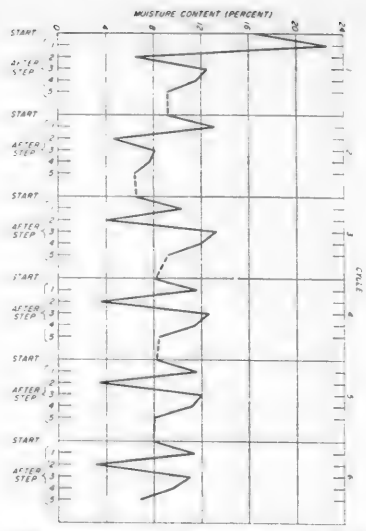

Fig. 3.—Average moisture content of the 20 specimens of the control group after various steps and for six cycles.

In using this system of rating for surface checks, the values assigned a specimen were cumulative. That is, the values were carried forward or increased as indicated with the steps of the cycle or the additional cycles. After the first and third steps of the cycle exposure test, the surface checks were closed. The surface checks often were then difficult to detect, so that the previous surface-check rating would still be assigned to the specimen. The maximum surface checking for any particular cycle was usually found after step 4, infrared heating, although the additional drying of step 5 of the cycle occasionally caused more surface checks to develop.

Collection of Data

Green Moisture Content: In order to kiln dry the blanks from which the specimens were eventually cut, it was necessary to prepare kiln samples. The moisture content sections cut from the freshly sawn plank provided green moisture-content data. In kiln runs 1 and 2, six kiln samples were used, and in kiln run 3, eight were used. In all three kiln runs, kiln samples that were representative of the stock were selected. The average-green-moisture content of the two moisture sections cut for each kiln sample is given in Table 3. The average for the kiln samples of kiln run 1 was 86.7 percent, for kiln run 2 it was 83.0 percent, and for kiln run 3 it was 88.4 percent. The grand average-green-moisture content was 86.3 percent.

Moisture Content When Specimens Were Prepared: As previously mentioned, all of the planks in the kiln charge were examined for surface checking when their moisture content was about 40 percent. Surface-check-free areas were marked for later specimen preparation. The stock was kiln dried to about 20 percent, and the specimens then were cut, numbered, and assigned to treatments. Specimens were cut to exactly 24 inches in length, and a 1-inch moisture section was cut adjacent to each end of the specimen. Calculated oven-dry weights of the specimens were computed from the moisture values obtained.

The moisture content values after each step were calculated for the control group of specimens, based upon the known calculated oven-dry weight of the specimens and weight data after all steps of the six cycle exposures. The average moisture content of each of the 20 control specimens is given in Table 4. The changes in moisture content from step to step in a cycle, and from cycle to cycle, are indicated. The moisture regain in cycle 2 after step 2 was not so great as in cycle 1 and subsequent cycles, because the wet-bulb temperature in the drying chamber was not maintained at the desired level. After cycle 2 was completed, the wet-bulb control was readjusted to maintain the desired 90 percent relative humidity.

No attempt has been made to show similar moisture content changes for the treated specimens. With a changing tare weight of preservative, the moisture content estimates at any time during the cycle exposure tests would be subject to errors. Moisture content changes of the untreated controls indicate the maximum and minimum values that the treated specimens might have attained. It is recognized, however, that the preservatives may have retarded moisture changes in both the sorption and desorption phases of the cyclic exposure test.

Preservative Treatment: The cut specimens were stored in a humidity room maintained at 80° F. and 90 percent relative humidity until they were needed for the preservative treatments. After the preservative treatments, the specimens were stored in the Laboratory where they were allowed to drain.

After exploratory treatments of representative red oak specimens to determine proper initial air pressures, the test specimens were treated by the empty cell process, with the preservative temperature varying from 185° to 210° F., a treating pressure of 175 pounds per square inch for 3 hours, and a final vacuum equivalent to 25 to 27 inches of mercury for 30 minutes. There was no initial air pressure

used in the empty cell treatment of pentachlorophenol solution with 101E oil and the treatment 5 with aromatic HB oil. The initial air pressure for the other preservatives was applied for 15 minutes, as follows:

Preservative	Air Pressure P.s.i.
Coal tar creosote (treatment 4)	35
Creosote-coal tar solution (treatment 3)	20
Creosote-petroleum solution (treatment 2)	28
Pentachlorophenol in 24 plus burner oil (treatment 6)	25
Pentachlorophenol in decant oil C (treatment 7)	10

Each specimen was weighed before and after treatment, and the preservative retentions obtained for the individual specimens. Both the creosote and the two creosote solutions were later found to contain considerable moisture. It was necessary therefore to correct the retention values of these specimens to a dry oil basis. Such a correction was unnecessary for the four pentachlorophenol solutions, which were checked and found to contain only from 0.1 to 0.2 percent of moisture.

Cycle Exposure Tests: The cycle exposure tests were started on September 1, 1957, and the six cycles were completed on April 12, 1958. After each step of the cycle exposure test, the specimens were weighed, and the surface checks were measured and recorded.

Analysis of Results

Moisture Content Changes During Cyclic Exposure Tests: The mean moisture content values of the untreated controls, as given in Table 4, are plotted in Figure 3. The mean values for the various cycles of exposure and the steps of the cycle are as shown in Table 5.

The moisture content increase during step 2 of cycle 2 is not as great as in the other cycles because of the lower equilibrium moisture content condition that prevailed in the drying chamber. The moisture changes that occurred during the last four cycles, however, averaged as follows:

Step 1—water spray—increase 3.72 percent
Step 2—low relative humidity—decrease 7.70 percent
Step 3—high relative humidity—increase 8.67 percent
Step 4—infrared heating—decrease 1.20 percent
Step 5—low relative humidity—decrease 2.87 percent

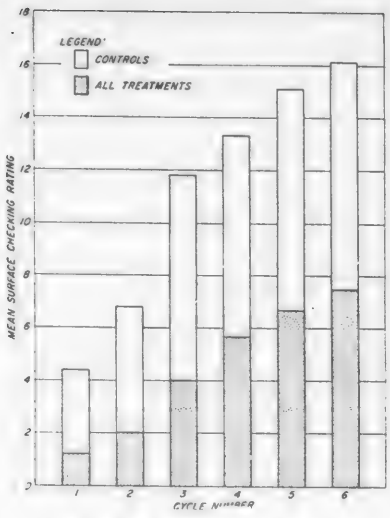

Fig. 4.—Surface checking rating after various cycles.

The low relative humidity exposure condition at a high temperature was effective in creating a moisture loss, and the 2-weeks' exposure to a high relative humidity at a moderate temperature resulted in appreciable moisture regain. Although infrared heating did not result in much overall moisture loss, the surface heating apparently created a very steep moisture gradient. After 6 hours of such exposure, the surface checks were open, and the additional drying at low relative humidity occasionally increased the severity of surface checking over that observed after infrared heating. The moisture changes of the controls during the cycle exposure conditions were sufficiently great to cause checking to develop after one cycle. The mean-moisture-content values show that the final values were decreasing as the cycles were repeated, suggesting that a change in hygroscopicity due to repeated heating was occurring.

Surface-Check Rating After Cycle No. 1: The mean-surface-check ratings for the various treatments after one complete cycle of accelerated weathering were found to be as follows:

Treatment No.	Mean-surface-check rating
1	4.40
2	1.05
3	.10
4	1.10
5	1.95
6	1.20
7	1.35
8	1.75

To determine if significant differences in these means exist, an analysis of variance was computed. The differences between treatment means are significant at the 1 percent level. The least significant mean difference at the 1 percent level is 2.43. The mean for treatment No. 1, the controls, is significantly larger than all the other treatment means. The least significant mean difference at the 5 percent level is 1.83. The treatment mean for treatment No. 3, creosote and coal tar (70-30), is smaller than the mean for treatment No. 5, penta in medium gas oil, and treatment No. 1. No other significant differences between treatment means are indicated.

The difference between the surface-check-rating means of the rough and dressed specimens is not significant. The mean values are 1.64 for the rough specimens and 1.59 for the dressed specimens.

Surface-Check Rating After Cycle No. 2: The mean-surface-check ratings for the various treatments after two complete cycles of accelerated weathering were as follows:

Treatment No.	Mean-surface-check rating
1	6.80
2	1.95
3	.95
4	1.80
5	2.95
6	1.75
7	2.25
8	2.45

The differences between treatment means are significant at the 1 percent level, and the least significant mean difference between treatments at the 1 percent level is 3.20. The mean for treatment No. 1, the controls, is significantly greater than all of the other treatment means. No significant differences between the other treatment means are indicated at the 1 percent level. The least significant difference between means at the 5 percent level is 2.40. None of the treatment means, other than treatment No. 1, is significantly different. After cycle No. 1, the mean for treatment No. 3 is smaller than the mean for treatment No. 5 at the 5 percent level, but after two cycles of accelerated weathering, this difference is no longer indicated.

The difference between the surface-check-rating means of the rough and dressed specimens is not significant. The mean values are 2.64 for the rough specimens and 2.59 for the dressed specimens. It is interesting to note that the increases over the results after cycle No. 1 are exactly the same.

Surface-Check Rating After Cycle No. 3: The mean-surface-check ratings for the various treatments after three complete cycles of the acceler-

ated weather exposure conditions were as follows:

Treatment No.	Mean-surface-check rating
1	11.80
2	3.90
3	3.10
4	4.05
5	4.35
6	4.00
7	4.75
8	3.85

The analysis of variance of the data collected after the third cycle exposure test indicated significant differences at the 1 percent level. The least significant difference between any two treatment means at the 1 percent level is 3.98. The mean for treatment No. 1, the controls, remains highly significantly greater than the means for the other treatments. No significant differences between the other treatment means are indicated, as was true after cycle No. 2. The least significant difference between treatment means at the 5 percent level is 2.99. None of the treatment means, except No. 1, are significantly different at the 5 percent level, as also was true after cycle No. 2.

The difference between the surface-check-rating means of the rough and dressed specimens is not significant. The mean values are 5.39 for the rough specimens and 4.56 for the dressed specimens. It is interesting to note that the mean for the dressed specimens through all of the first three cycles of exposure was consistently less than the mean for the rough specimens, although the difference is not great enough to be of statistical significance. The three sets of means are as follows:

Cycle exposure	Mean-surface-check rating: Rough specimens	Mean-surface-check rating: Dressed specimens	Difference
1	1.64	1.59	0.05
2	2.64	2.59	.05
3	5.39	4.56	.83

The difference between the means increases considerably after cycle No. 3 as compared with the results after cycles Nos. 1 and 2.

Table 3.—GREEN MOISTURE CONTENT OF 2- BY 8-INCH PLANK

Kiln run	Moisture content Percent	Average moisture content Percent
1	80.0	
	79.3	
	94.7	
	93.7	
	85.6	
	86.9	
Total	520.2	86.7
2	75.1	
	68.5	
	92.5	
	93.0	
	83.9	
	85.3	
Total	498.3	83.0
3	83.2	
	83.1	
	89.2	
	86.0	
	90.7	
	87.9	
	92.4	
	94.3	
Total	706.8	88.4
Grand total	1,725.3	86.3

Table 2.—PROPERTIES OF COAL-TAR AND CREOSOTE SOLUTIONS

Property	Coal-tar creosote	Creosote petroleum 50–50 solutions
Specific gravity at 38° C./15.5° C.	1.082	1.0315
Benzol imsol, percent	1.03	0.44
Moisture, percent	6.1	4.9
Coke residue, percent	2.64	------
Distillation up to:		
210° C., percent	0	0
235° C., percent	4.4	1.0
270° C., percent	30.2	13.4
315° C., percent	52.5	37.0
355° C., percent	74.7	56.8
Residue, percent	24.8	43.2
Volatiles, percent	0.5	0
Total	100.0	100.0
Specific gravity fractions at 38° C./15.5° C.		
235° C. to 315° C.	1.0366	0.9995
315° C. to 355° C.	1.1035	1.0275

Surface-Check Rating After Cycle No. 4: The mean-surface-check ratings for the various treatments after four complete cycles of the cycle exposure conditions are as follows:

Treatment No.	Mean-surface-check rating
1	13.15
2	5.65
3	4.90
4	5.90
5	6.50
6	5.30
7	6.00
8	5.30

The analysis of variance of the data after the fourth cycle indicates significant differences at the 1 percent level. The least significant mean difference between treatments is 4.81. The mean for treatment No. 1, the controls, remains highly significantly greater than the other treatment means. No significant differences between any two of the other treatment means are indicated, as was true after cycles Nos. 2 and 3. The least significant difference between treatment means at the 5 percent level is 3.62. None of the treatment means, except No. 1 are significantly different at this 5 percent level of testing, as was true after cycles Nos. 2 and 3.

The difference between the surface-check-rating means of the rough and dressed specimens is now significant at the 1 percent level. The mean values are 7.58 for the rough specimens and 5.64 for the dressed specimens. The means and differences between the means for the rough and dressed specimens for the four cycles are as follows:

Cycle exposure	Mean-surface-check rating: Rough specimens	Mean-surface-check rating: Dressed specimens	Difference
1	1.64	1.59	0.05
2	2.64	2.59	.05
3	5.39	4.56	.83
4	7.58	5.64	1.94

With repeated cycle exposure testing, the rough specimens after four cycles surface checked more than did the specimens that were cut out of boards that were surfaced before being kiln dried.

Surface-Check Rating After Cycle No. 5: The mean-surface-check ratings for the various treatments after five complete cycles of accelerated weathering exposure conditions are as follows:

Treatment No.	Mean-surface-check rating
1	15.05
2	7.50
3	5.50
4	6.60
5	7.15
6	6.15
7	6.75
8	6.75

The analysis of variance indicates that the difference between means is significant at the 1 percent level. The least significant mean difference be-

tween treatments at the 1 percent level is 4.87. The mean for treatment No. 1 the controls, remains highly significantly greater than the other treatment means. No significant differences between the means of other treatments are indicated. The least significant difference between treatment means at the 5 percent level is 3.67. The treatment mean for No. 1 is greater than all the others, and no difference between the other treatment means is indicated at this 5 percent level of testing.

The difference between the surface-check-rating means of the rough and dressed specimens is significant at the 1 percent level. The mean values are 8.61 for the rough specimens and 6.75 for the dressed specimens. The means and differences between the means for the five cycles are as follows:

Surface-Check Rating After Cycle No. 6: The mean-surface-check ratings for the various treatments after six complete cycles of accelerated weathering exposure conditions are as follows:

Treatment No.	Mean-surface-check rating
1	16.10
2	7.95
3	5.75
4	7.40
5	8.00
6	7.10
7	8.05
8	7.60

Cycle exposure	Mean-surface-check rating		
	Rough specimens	Dressed specimens	Difference
1	1.64	1.59	0.05
2	2.64	2.59	.05
3	5.39	4.56	.83
4	7.58	5.64	1.94
5	8.61	6.75	1.86

The difference between the means after the fifth cycle is somewhat less than was found after the fourth cycle.

The analysis of variance of the surface-checking data obtained after the sixth cycle of exposure was completed indicates that differences between treatment means are significant at the 1 percent level, as was true after all of the previous cycles. The least significant mean difference at the 1 percent level is 5.05. The mean for treatment No. 1, the control group, is highly significantly greater than the other treatment means, and no other differences are indicated. The least significant mean difference at the 5 percent level is 3.80. The mean for treatment No. 1 is significantly greater than all the other means, and no other significant differences exist at this level of testing. The preservative treatments were all equally effective in reducing the extent of surface checking as compared with the untreated controls. None of the preservative treatments appears to be superior to the others in this respect.

The means for the various preservative treatments have been pooled to provide a comparison with the means for the controls or untreated specimens. The data are plotted in Figure 4. The difference between the mean-surface-check rating for the controls of treatment No. 1 and the pooled mean of the preservative treatments Nos. 2 to 8, inclusive, increases as the number of cycle exposures increases. The exception to increasing differences with additional cycle exposures is found after cycle No. 4. The differences between means for the controls and for the pooled treatments for the various cycles are as follows:

Cycle No.	Mean-surface-check rating		
	For controls	For all pressure treatments	Difference
1	4.40	1.21	3.19
2	6.80	2.01	4.79
3	11.80	4.00	7.80
4	13.30	5.65	7.65
5	15.05	6.63	8.42
6	16.10	7.41	8.69

The treatment-mean-surface-check ratings for the various preservative treatments are plotted as a bar chart in Figure 5. The means are in order of the array, and the outstanding indication is that treatment No. 3 (creosote-coal tar (70–30)) consistently had the lowest ranking for all cycles. The difference between the surface-check-rating mean for treatment No. 3 and the means for treatment No. 7, the maximum, after the sixth cycle is 2.30. The difference is significant at about the 25 percent level, indicating that in three out of four trials in a similar experiment, treatment No. 3 would have a mean difference as great as 2.30 when compared with the maximum surface-check-rating mean. Although the 25 percent level is not considered as being high enough to justify drawing conclusions of significance, the low value for treatment No. 3 and its consistency for all cycles may be of some practical importance.

To further test the significance of the difference between the mean-surface-check-ratings, an analysis of variance was made involving the data

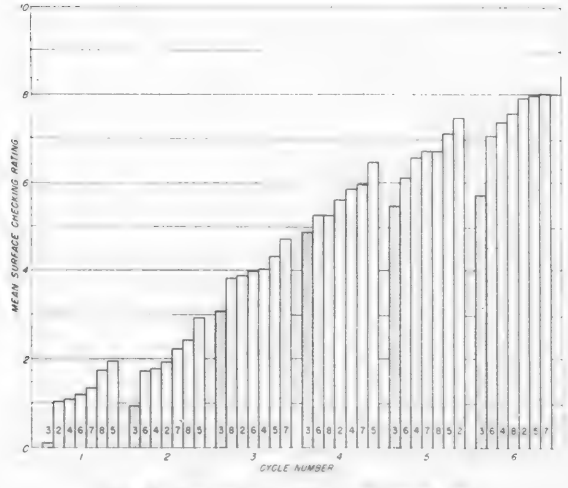

Fig. 5.—Mean surface checking rating for various preservative treatments.

Fig. 6.—Mean surface checking rating after various cycles for rough and dressed specimens.

Table 4.—AVERAGE MOISTURE CONTENT OF "CONTROL" SPECIMENS AFTER VARIOUS STEPS IN SIX CYCLES OF EXPOSURE TEST

At start	After step No. 1	2	3	4	5	At start	After step No. 1	2	3	4	5
	CYCLE 1						CYCLE 2				
16.7	22.5	6.5	12.5	11.6	9.2	9.2	13.1	4.6	8.1	7.7	6.4
	CYCLE 3						CYCLE 4				
6.5	10.4	4.0	13.2	11.9	9.2	8.1	11.6	3.6	12.6	11.4	8.4
	CYCLE 5						CYCLE 6				
8.2	11.6	3.4	12.0	11.1	8.0	7.9	11.3	3.1	11.0	9.6	6.9

of all six cycle exposure tests. Two analyses of variance were computed. In one, the controls (treatment No. 1) were included, and in the other, they were excluded. Here again, the mean for the controls is highly significantly different than the other treatment means, while the means for the various preservative treatments are not significantly different.

It is concluded that the seven different preservative treatments did not effectively develop different responses, as measured by surface checking, in the accelerated weather exposure conditions of this experiment. In other words, the specimens containing preservatives with pentachlorophenol did not surface check more or less than those containing the creosote or creosote solutions.

The surface-check-rating means for the cycle groups after the sixth cycle are as follows:

Cycle group No.	Mean-surface-check rating
1	8.31
2	9.75
3	9.19
4	9.94
5	7.94
6	5.50
7	9.31
8	6.50
9	7.50
10	11.00

An analysis of variance indicates that significant differences are to be found only at the 5 percent level. The least significant difference between these cycle-group means at the 5 percent level is 3.22. The mean value for cycle group No. 10 is the maximum value, and it is significantly greater than the means for cycle groups Nos. 6, 8, and 9.

After six complete cycles of exposure conditions, cycle groups Nos. 6 and 10 have established their positions in the array as consistently being in the first and last positions. Cycle groups Nos. 2 and 4 appear to have established the eighth and ninth positions in the array. It is likely that these four cycle groups were not greatly affected by variations in the cycle exposure conditions; the inherent characteristics of the specimens to surface check are more pronounced. The differences between the means of these groups are because of chance causes of specimen assignment. The changes in ranking of the other cycle-group means from cycle to cycle presumably are because of variations in cycle exposure test conditions which were associated with experimental error.

The combined analysis of variance shows that the differences between the means of cycle groups are significant at the 1 percent level, but that the interaction between cycle groups and cycles is not significant. This indicates that the cycle exposure conditions between cycles did not significantly affect the cycle-group means. In other words, the variations in cycle exposure conditions as between cycles were within experimental error as measured by surface checking effects. The interactions between cycle groups and treatments, however, are significant. This indicates that some treatments influenced the mean-surface-check rating more so than others for some cycle groups. Because of the few specimens representing each treatment in each cycle group, it was previously concluded that chance causes of specimen assignment to cycle groups were probably more influential than any other factor. Those treatments causing differences between the means of cycle groups were not determined. The main conclusion that can be drawn is that the necessity to split up the total number of specimens into cycle groups for processing through the accelerated cycle exposure test conditions did not introduce important effects into the experiment.

The analysis of variance after the sixth cycle indicates that the means for surface-check ratings between the rough and dressed specimens are highly significant. The mean values are 9.66 for the rough specimens and 7.32 for the dressed specimens. The means and differences between the means for all six cycles are as follows:

Cycle exposure	Mean-surface-check rating: Rough specimens	Dressed specimens	Difference
1	1.64	1.59	0.05
2	2.64	2.59	.05
3	5.39	4.56	.83
4	7.58	5.64	1.94
5	8.61	6.75	1.86
6	9.66	7.32	2.34

The differences are significant after the fourth, fifth, and sixth cycles. The data are shown as bar charts in Figure 6. The combined analysis shows that the difference in the two surface conditions is highly significant. The surface-check ratings of the rough and dressed specimens for the various treatments after the sixth cycle show that the means for the controls are the same, so the differences in surface checking between the treatments are due to the effect of the preservatives. The creosote-containing specimens all show a marked reduction in surface checking for the dressed specimens as compared with the rough specimens. The residual fuel oil with pentachlorophenol resulted in a reverse effect; the rough specimens surface checked slightly less than the dressed specimens. The other pentachlorophenol solutions resulted in a reduction in surface checking for the dressed specimens. Treatment No. 8, heavy cycle oil with pentachlorophenol, compared favorably with the creosote preservatives. The general indication is that treated wood will surface check less under conditions of exposure similar to those of this experiment when it is surfaced before the seasoning and the preservative treatments.

Surface-Check Rating Based on Rough or Dressed Specimens Only: Analysis of surface-check-rating data after each cycle and the combined analysis of the data show that the means differ significantly at the 1 percent level. The controls surface checked more than the treated specimens, while no significant differences were indicated among the means for the treated specimens regardless of the preservative used. Because of the disproportionate distribution of rough and dressed specimens to treatment groups, surface condition may have influenced the general indication that the treatment means, other than the controls, did not significantly vary between themselves. Do the treatment means in each of the two classifications (rough and dressed) have differences of statistical significance? To answer this question an independent analysis of variance was made for the two classifications. The analysis in both cases shows that the controls surface checked more than the treated

specimens and, further, that no significance in mean-surface-check rating exists between the preservative-treated groups.

Interpretation

The purpose of this study was to determine if creosote- and pentachlorophenol-containing preservative solutions reacted differently in their tendency to retard surface checking of oak in an accelerated weathering test. The data plotted in Figure 3, indicate that the cyclic exposure test conditions created desorption and sorption moisture gradients which are believed essential to create surface checking conditions. The treated and untreated specimens were exposed to six cycles of accelerated weathering conditions. The analysis of surface-check-rating data indicates that significant differences in surface checking tendencies between treatment groups are not present. The pentachlorophenol-containing solutions were just as effective as the creosote solutions.

All preservatives effectively reduce surface checking as compared with untreated controls. It is not likely that the preservatives have antishrink properties. Thus the differences in surface checking between the untreated controls and the treated specimens must be accounted for by a retardation of moisture changes. The plot of the surface-check data in Figure 5 suggests that treatment No. 3, creosote-coal tar (70:30 percent), probably is more effective than the other preservative solutions in this respect. The mean-surface-check rating for this treatment group is consistently less than the others after each of the six cycle exposure tests.

To extend the results of this surface-check study to the performance of preservative-treated railroad crossties is not within the scope of this investigation. The inference might be made that railroad crossties treated with preservatives containing pentachlorophenol are not expected to surface check and split any differently than crossties treated with creosote solutions. As crossties are dried before treatment, surface checking has developed, and whether the various preservative treatments influence the extension and penetration of old checks and splits and the development of new checks differently when some are already present cannot be interpreted from the data obtained in this experiment.

An interesting result of this investigation was the establishment that there was less surface checking in the accelerated weathering test among specimens cut from planks which were surfaced before drying than there was among specimens cut from normal sawmill rough-cut plank. If crossties could be seasoned without surface checking before treatment with a preservative, the interpretation is that surfaced ties would surface check and split less in service than rough-sawn ties. The shrinkage and checking characteristics of boxed-heart crossties are much different than flat-sawn side-cut plank, and the application of the results of this research to crosstie seasoning, preservation, and use is questionable. The finding, however, does have applicability in the seasoning of surface-check-prone species and in the seasoning, preservative treatment, and exposure of treated wood in lumber and plank dimensions. Surfacing before seasoning and preservative treatment is believed to be effective in minimizing surface checking in subsequent use exposure conditions. The reduction, although significant in this experiment, might not be of practical importance.

Table 5.—MEAN MOISTURE CONTENT OF CONTROLS (TREATMENT NO. 1)

Cycle No.	Moisture content					
		After steps				
	Start Percent	1 Percent	2 Percent	3 Percent	4 Percent	5 Percent
1	16.7	22.5	6.5	12.5	11.6	9.2
2	9.2	13.1	4.6	8.1	7.7	6.4
3	6.5	10.4	4.0	13.2	11.9	9.2
4	8.1	11.6	3.6	12.6	11.4	8.4
5	8.2	11.6	3.4	12.0	11.1	8.0
6	7.9	11.3	3.1	11.0	9.6	6.9

Conclusions

Three major conclusions are drawn from this experiment in accelerated weathering of treated and untreated red oak specimens to determine the effectiveness of preservative solutions in reducing surface checking.

All preservatives included in the experiment effectively reduced the amount of surface checking that occurred in accelerated weathering as compared with untreated controls.

No significant differences were found in the effectiveness of the different preservative solutions used in the experiment to minimize surface checking in the accelerated weathering tests.

Surface-check-free specimens obtained from plank that were planed before drying and preservative treatment, surface checked less in subsequent accelerated weathering than did specimens cut from rough-sawn plank.

Two minor conclusions can also be gained from the experiment.

In a species like red oak, surface checking can be accelerated by an artificial weather exposure condition creating moisture regain and drying gradients.

The surface-check-rating technique used in this study is satisfactory.

Recommendations

The experimental results of this experiment indicate that oils containing pentachlorophenol might be as effective as creosote preservatives in retarding the development of surface checks in a wood like oak when exposed to weathering conditions. The experimental results need to be verified by long-term field tests under use conditions. Because of the costs involved in making such tests with railroad crossties, it is recommended that the accelerated weathering experiment be replicated with fewer preservative solutions and many more specimens. Consideration also needs to be given to the use of a specimen that is boxed heart rather than side cut, and the complication of differences in surface roughness should be avoided. Should the replicated experiment confirm the indications of this experiment, a crosstie placement study should be considered. In the meantime, observations of surface checking and splitting in crossties treated with preservatives containing pentachlorophenol should be intensified to obtain a confirmation of the results of this experiment.

Although the effectiveness of machine surfacing or "blanking" of green wood members on reducing surface checking may be of more importance in seasoning than in preservation, the finding of this experiment needs verification, particularly if checking of treated lumber of dimension sizes is a real problem.

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Wooden Pallets and Pallet Containers...

Present and Future Markets[1]

WILLIAM H. SARDO, JR.
National Wooden Pallet Manufacturers Association, Washington, D. C.

THE INCREASING USE OF WOODEN pallets since World War II has been one of the outstanding postwar developments in the American lumber industry. The pallet, which had its birth in the mid-1930's, achieved major use when the military services began to use it to speed the warehousing, handling, and delivery of supplies during World War II. The fork-lift truck and the wooden pallet combination created the "cubic concept" of modern warehousing, which permits the use of air space as well as floor space in storage areas and transportation vehicles.

Today, the wooden pallet is a basic tool of modern materials handling and automation. Savings in labor and handling costs average between 40 and 45 percent, which when coupled with the many side benefits explains the phenomenal growth of the wooden pallet manufacturing industry over the past 5 years. This industry, which economists say is the fastest growing segment of the lumber industry today, produced more than 62,308,000 units valued at approximately $162,811,000 in 1960. This production set a new all-time record, and represented a 7.91 percent increase over the previous record year of 1959. Lumber consumed for pallets in 1960 was estimated to exceed 1,557,700,000 board feet or about 4.38 percent of the national lumber production, which was reported at about 35.5 billion board feet for the past year. This was the highest percentage of total lumber output ever consumed by the wooden pallet industry, and is an indicator of its growing importance to the overall lumber industry.

The wooden pallet accounts for a little more than 98 percent of the permanent pallets sold in the United States, while substitutes account for less than 2 percent of the total. Five years ago, only 50 percent of the expendable or one-trip pallets were produced of wood; today, more than 80 percent of the expendable pallets are made from lumber or allied products.

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Pallets and Handling Equipment

Modern materials handling equipment and pallets go hand-in-hand. There is a market for pallets wherever a fork-lift truck or other mechanized equipment is used to move packaged or bulk goods from one place to another. Some years ago pallets were limited to interaplant use, but today pallets are used for almost every type of operations where they can make savings possible. Many, many industries have added materials handling departments to their staff, charged with the sole responsibility of speeding the flow of materials in both intraplant and interplant shipments. More and more companies now demand that their suppliers ship their products on pallets as they have found further savings in shipping and receiving in unit loads, eliminating manual handling in and out of freight carriers. The National Wooden Pallet Manufacturers Association (NWPMA) has compiled a list of 16 advantages which a good palletization program can offer to the average user. These are as follows:

1. By utilizing air space as well as floor space, a palletization program increases the amount of goods storable in any given area.
2. Personnel accidents are reduced by substituting mechanical for manual handling and lifting.
3. Savings in handling costs resulting from palletization range between 25 and 80 percent, averaging from 40 to 45 percent.
4. Handling time is reduced with a resulting saving in man hours and often elimination of overtime wages.
5. Pallet loading affords ventilation of merchandise in warehouses and during shipments.
6. Palletization simplifies inventorying and to a great extent eliminates inaccuracies in counting and inventory controls.
7. Case histories show adoption of mechanical handling methods and palletized shipments result in almost total elimination of damage to goods in transit.
8. Unitized pallet loads reduce labeling time and expense, since one or two labels per load eliminate the need for marking individual units.
9. Pilferage is reduced when individual items are securely strapped or glue fastened to pallets in unitized bonded loads.
10. Palletization permits uniform placement of stock and results in uncluttered aisles and clean floors.
11. Pallets form a natural "subflooring" to which steel strapping can be easily and securely anchored.
12. Use of pallets often eliminates costly conveyor systems and permits delivery, loading, and unloading at any point accessible to the handling equipment.
13. Pallets fit well into manufacturing phases of goods thus cutting down production interruptions and bottlenecks.
14. Production workers need not lose valuable time in "lending a hand" in moving materials.
15. By cutting in half loading and unloading time of carriers, and in some cases permitting the loading into one car those items contained in two or three "old-method" carloads, palletization eliminates demurrage charges, in effect greatly increases the utility of carrier equipment, and increases freight revenues to carriers.
16. Steamship loading and unloading time can be reduced with use of pallets, resulting in faster turnaround of ships, and reduction of costs. Savings are more clearly visualized when it is realized that costs of loading and unloading cargoes are many times greater than those involved in operating a vessel between two ports 1,000 miles apart.

Pallet Containers

Concurrent with the growth of the use of flat wooden pallets has been an increasing use and interest in pallet containers of all types. Pallet containers are nothing more than large

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The wooden pallet industry represents one market where wood's share of the pie is getting larger rather than smaller. At least two independent management consultant firms have classified the industry as the only growth segment of the lumber and wood products industry. Here, the author points out why the wooden pallet accounts for a little more than 98 percent of the permanent pallets sold in the U. S., while substitutes account for less than 2 percent.

boxes with integral pallet bases or containers so designed that they can be secured to separate pallet bases. These containers are manufactured of nailed lumber, plywood, wirebound, fiberboard, metal, plastics, or other materials. They are divided roughly into three categories, namely 1) pallet crates which have open slatted sides and ends with a pallet base; 2) pallet bins which have closed sides and ends with a pallet base; and 3) pallet boxes which have closed sides, ends and tops with a pallet base. Pallet-container handling is merely the substitution of a smaller number of large containers and fewer handlings for numerous smaller containers and a greater number of handling. This means that where relatively lightweight, low-cost pallet containers are used, the tare weight of the containers is less in proportion to the net weight of the product therein than is the tare weight of the greater number of smaller containers required to hold the same amount of goods. More important, it means greatly reduced labor requirements for loading, unloading and related handlings. Also, in many instances the density of the loads placed in the pallet containers can be increased considerably, which results in savings per pound of product in transportation, and in refrigeration costs where produce or perishables are involved. There is also ample evidence to indicate that far less commodity damage occurs during transportation and handling of goods in pallet containers.

In the opinion of the NWPMA, the pallet container market offers a potential that is at least five times greater than the flat wooden pallet market at present. Pallet containers are being used to good advantage to increase the efficiency and lower the costs of storage, handling, transportation, and harvesting of various agricultural as well as industrial products. They have been employed for industrial products almost since World War II, but for some unexplained reason the manufacturers of wooden pallet containers have let this market go uncontested to metal containers. However, in the agricultural field where pallet containers have been used only for the past 4 years, wood reigns supreme at the present time.

The pallet container was the result of an attempt to adapt pallets to the handling and storage of small unpackaged items or bulk commodities. At first, these large containers were used only for various industrial products such as bolts, machine parts, or castings.

The first large scale application of pallet containers in the agricultural field was for harvesting and handling from field to packing, processing, and cold storage plants and for handling within these facilities. Today, a wide variety of agricultural perishables, including apples, citrus fruits, watermelons, pears, potatoes, beans, peppers, and cucumbers are being harvested, handled and shipped in these large containers.

The increase in use of pallet containers in this field in the last 5 years has been outstanding. In the 1957 harvesting season, for example, less than 2 percent of the Washington State apple crop was harvested and stored in pallet containers. In 1960, more than half the apple crop was harvested and handled in these large containers. This involved a total of about 4,000,000 containers.

The next application of pallet containers in the agricultural field was transportation. Development and use of pallet containers for this purpose, however, has proceeded at a much slower pace because of the many complex problems involved. Among the more important factors which have limited their use for this purpose are: 1) The question of ownership of the containers, particularly the more costly nonexpendable, reusable types for shipments over relatively great distances; 2) the problem of tare weight of the containers when shipped with the commodity in them and when being returned to the shipping point for reuse; 3) lack of adequate facilities and equipment at shipping and receiving points for filling, loading, unloading, and dumping the large containers; and 4) problems of container design, loading, refrigeration, and adequate bracing of the loads as related to the densities, natural characteristics, and requirements of various agricultural perishables.

Market Growth and Expansion

To expand markets the NWPMA published three different standards covering wooden pallet and pallet container construction. These are: specifications and grades for hardwood warehouse pallets; minimum standard specifications for warehouse pallets of West Coast woods; and most recently, specification for Douglas-fir and Western softwood plywood pallets. The latter is a joint publication with the Douglas Fir Plywood Association. NWPMA has also issued a group of technical publications, such as a technical handbook on pallets and palletization, technical leaflet on expendable pallets, and a technical pamphlet on the care and maintenance of wooden pallets. Publications have been issued on customer inspection procedure, and test methods for evaluating loaded wooden pallets in actual use operations. In connection with the three published standards covering the various types of wooden pallets, a grade mark system has been instituted. This system involves four grades for hardwood pallets, four grades for pallets made of West Coast woods, and two grades for pallets and pallet containers made of Douglas-fir plywood.

To publicize the industry's products, NWPMA carries on a cooperative advertising campaign in a number of leading trade journals in the materials handling field, and displays products at various trade expositions throughout the country each year. To improve the competitive situation for products, the NWPMA has successfully achieved lower freight rates for carload shipments of pallets, and free pallet allowances on the movement of palletized freight both by rail and motor carriers.

We also engage in the study of the weaknesses of substitutes for our products as well as the advantages of such substitutes, since this information will enable us to know the seriousness of such threats. To acquaint our customers with problems dealing with specifications, purchase, use, and inspection of wooden pallets NWPMA sponsors two annual Pallet Users' Conferences, one in the East and one in the West. We also hold an annual Manufacturing and Sales Promotion Clinic for the benefit of both members and nonmembers.

Research and Development

The modest research and development work conducted by NWPMA has been done mostly in conjunction with other organizations such as the United States Forest Products Laboratory, the New York State College of Forestry, and the Douglas Fir Plywood Association. We have also conducted a few studies with colleges and universities on various aspects of palletization, but most of this work is still in progress and not ready for publication.

One of our recent internal research projects led to the development of a new four-way pallet design made with plywood disk separators, which take the place of the conventional sawn wooden blocks. This is known as the "Ply-Block" pallet. A pallet user or prospect is interested in this development because 1) the plywood disk separators are usually cheaper than the conventional wooden blocks; 2) the forks of the lift-truck cannot damage these cylinders or separators as easily as they do the conventional wooden blocks; 3) pallets made with the plywood disk separators are easier to repair than those constructed with nailed wooden blocks; and 4) the plywood disk separators permit a larger opening for the entrance of the forks or hand pallet trucks because of their smaller cubic size as compared to the conventional wooden block.

Headaches of the Industry

Palletless handling offers a major threat to this industry. This technique takes a large number of different forms, but the main threats come from three particular systems. These are the use of 1) the clamp truck, 2) the Poke-Pac or Pull-Pack method, and 3) the Unit Load Car System employing the Cartwright truck. All of these systems claim a multitude of savings. After extensive research, however, the NWPMA has been able to prove that the only saving attributable to these systems is the elimination of the original investment in wooden pallets. The greatest threat to the future of the wooden pallet industry comes from the industry itself. It takes the shape of poor quality products, and the typical wood fabricators' viewpoint of quantity rather than quality.

This wood fabricators' viewpoint has been the main stumbling block of the wood products industries for at least 50 years. The philosophy involves an attitude of make it, use it, waste it, and pay no attention to producing a better product that lasts longer or does a better job than substitutes. We are pleased to report that there has been ample evidence of a lessening of this philosophy in the wood products industries during the last 3 years. This is truly notable progress.

The main headache of the wooden pallet industry is that it probably has the lowest profit margin of any fabricated wood product. It is also a business that one can enter with the smallest possible amount of investment in equipment and physical assets. This often leads to persons of little or no financial responsibility becoming wooden pallet manufacturers. We can also report that the wooden pallet industry probably has the highest financial mortality rate in the lumber and wood products industries. Financial death in this industry might be termed quick and merciful. The biggest mistake made by the itinerant pallet producer upon entering this industry is to think that pallets can be made from raw material that formerly went to the burner as waste. Fortunately this idea has been dispelled considerably by forestry schools. the Forest Service, and the United States Forest Products Laboratory in recent years.

Profitable Challenges

The wooden pallet industry still has many interesting and profitable challenges ahead of it. It is still a growth industry! A production level of 70 million units per year for flat pallets alone is possible before 1965. The opportunities for new markets for wooden pallet containers is almost limitless. To accomplish these production goals and to continue its growth this industry must do many things. It must find ways and means to provide funds for adequate research and development to produce better, more economical, and longer lasting wooden pallet products. It must promote and fight aggressively for the establishment of Pallet Pools on an industry, regional and national level.

These Pools must be based on high quality permanent pallets, and can go far toward perpetuating wooden pallet products, because they drastically reduce the per-use cost of these products to the customer. Many pallet makers aggressively resist the Pallet Pool idea because in their minds it spells the doom of the vast volume of wooden expendable pallets. This to them can mean only reduced sales. These are the people, who can be the pallbearers of the wooden pallet industry, because they cannot visualize the real benefits of the Pallet Pool. Since the permanent pallet will last many times over the life of the expendable pallet, the permanent pallet used in a Pool will have a shorter life than usual; and represents greater dollar volume with higher profits.

The greatest challenge ahead of this industry is represented by the vast opportunities offered by an idea, which NWPMA calls "The Coming Revolution in Packaging and Materials Handling." The successful future of palletization truly threatens a revolution in the packaging and container fields. During 1960, government and industry sources estimated that $20 billion was spent for all forms of packaging in the United States alone. It is my opinion that this $20 billion represents a vast waste in the American economy.

"The Coming Revolution" has possibilities unlimited, and the savings could represent billions of dollars. This can only be accomplished by an elimination of many of the present concepts of shipping containers and the substitution for them of unit loading employing the reusable wooden pallet or pallet container. Under this concept, modern handling techniques could be followed to their fullest advantage, and the pallet product would act as a waiter's tray. The present individual shipping containers would be substituted for by Pallet-Pacs, Wrap-Paks, Wrap-Rounds, Power-Paks and collapsible unit containers. NWPMA has been engaged for more than 7 years with several universities and a number of industrial companies in a research and development project on this idea, and some of the results of this vast study will be made available to the public during 1961.

This new unit load principle applies only to volume and semi-volume items at present. So far, at least 19 different savings have been found possible to achieve under this system in the food industry alone. Several industrial users have begun experiments with it. As an example, General Electric employs this system for just one commodity, and as a result has increased its storage area by 30 percent, and has reduced the number of packaging materials by 96 percent.

Supremacy of Wood

We believe that wood can reign supreme in the years ahead as a natural resource product in the American economy. In the last 2 years, several wood products organizations have abandoned an inferiority complex and are aggressively fighting a common enemy—the substitute. Too much time and money has been spent by the lumber and wood products industries over the past 50 years in fighting one another's species, product, or region. Wood is a replenishable resource with man's aid. It is a wonderful product, and always be proud of your affiliation with any segment of the wood products industry!

Oregon Woods for Crossties[1]

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Crossties of 9 Oregon woods were tested for 4 to 11 years in main-line track of the Southern Pacific Company in several western states. Species differed in susceptibility to seasoning defects, preservative treatment, and mechanical wear. Few ties have failed, but service is expected to vary at different test sites.

SINCE THE INFANCY OF RAILROADS in the United States wood has been favored for crossties. During the years when untreated ties were used widely, durable heartwood of white oak was preferred for ties in the East, Douglas-fir for ties in the West, and longleaf pine in the South (5)[2]. Continued expansion of track systems, depletion of preferred species, and mounting costs of maintenance encouraged use of other species, with preservative treatment for extended service. Crossties, then, for many years, became the major product of the wood-treating industry in the United States. Oak species usually have ranked first in volume. In recent years, treatment of southern pine ties has decreased, while Douglas-fir has remained at about 10 percent of the annual production of treated crossties.

Preservative treatments have so extended the service life of crossties that they now normally remain in track until worn out mechanically. Strength properties (1) and treatability now contribute more than does natural durability of the wood to the service life of a treated crosstie. Early tests indicated that average service life of creosoted ties was 25 years for several species of western conifers, and 33 years for treated eastern hardwood ties, although virtually all species tested had low natural resistance to decay (2).

Cooperative work was initiated by the Southern Pacific Company and the Oregon Forest Research Center during 1947 to evaluate Oregon woods for use as treated crossties under a variety of conditions of railroad traffic. The Company normally purchases Douglas-fir ties and small amounts of other coniferous species (6). Species being studied are incense cedar, Shasta red fir, white fir, West Coast hemlock, mountain hemlock, lodgepole pine, ponderosa pine, Sitka spruce, and Douglas-fir. Tanoak, a west coast hardwood, is included at 3 of 18 test locations in Arizona, California, Nevada, and Oregon. Methods and results of air seasoning and preservative treatment of test ties before installation in track have been reported by Graham (3, 4).

Five of the test species, other than Douglas-fir, are represented in considerable volume as sawtimber in the western United States (see Table 1). Douglas-fir from Pacific Coast areas generally is rated a stronger wood than other coniferous species being tested. Mountain hemlock, however, exceeds Douglas-fir in hardness perpendicular to the grain (see Table 2).

Procedure

Experimental ties were sawed to 7- by 9-inch by 8-foot size from timber grown in areas of possible future sources of supply in Oregon. Timber of some species was from young-growth stands while other was from old growth. Generally, the wood had slightly lower ring count, percentage of summerwood, and specific gravity than is considered average for the various species. Ties were air-seasoned, bored and incised, then pressure-treated at Southern Pacific Company's plants at Eugene, Oregon, and at Oakland, California.

Seasoning: Softwood ties were piled by species in stacks for air-drying, and from 12 to 25 ties, well distributed throughout each seasoning pile, were weighed periodically to determine loss of moisture.

Half of the 120 tanoak ties seasoned at Eugene were air-dried in covered piles, the remainder were in uncovered piles. Twelve ties from each pile, six of which were end-coated with filled gloss oil, were weighed periodically. Tanoak ties were incised before drying; all other ties were incised after air seasoning. Split ties and heart-center ties of all species were check-bolted near the ends to retard end-splitting.

Preservative Treatment: Ties were pressure-treated with a solution of coal-tar creosote in petroleum after being air-seasoned, bored, and incised.

[1] Presented at the Northwest Section Meeting, Forest Products Research Society, Roseburg, Oregon. Approved for publication September, 1961.

[2] Numbers in parentheses refer to Literature Cited at the end of this report.

 Reprints Available. Circle Item 23.

Fig. 1.—Location of sites for study of crossties in Oregon, California, Nevada, and Arizona.

Typical composition and weight of a gallon of the solution at 100° F. were:

	Fraction[1]		
	Coal-tar Creosote	Gasco Distillate	Fuel Oil
Specific gravity	1.080	0.987	0.990
Weight, pounds	9.00	8.22	8.25
Composition by:			
Wt. (%)	25	25	50
Vol. (%)	23	26	51

[1] Weight listed is for a gallon of each fraction.

A number of ties of each species were weighed and bored after treatment to evaluate retention and penetration of preservative solution. Weight of solution absorbed by treated ties of each species was based on the average weight of a number of air-dried, untreated ties.

Installation and Inspection of Treated Ties: Treated experimental ties were installed in main-line tracks of the Southern Pacific Company in Arizona, California, Nevada, and Oregon and have been inspected annually to evaluate their performance. Track locations are shown in Figure 1. Inspected ties have been rated visually for severity of checking, splitting, plate-cutting, twisting, breaking, or combinations of these defects.

Ties in Oregon were inspected by members of the staffs of the Southern Pacific Company and the Oregon Forest Research Center. Those in other states were inspected by personnel of the Southern Pacific Company.

Results

Ties of some species were air-seasoned and preservative-treated as readily as those of Douglas-fir, and have been equally serviceable in track. Those of some other species appeared less satisfactory because of seasoning defects, lessened treatability, and lower resistance to deterioration during service.

Seasoning: Most softwood ties could be air-seasoned from early spring until fall to a moisture content of 30 percent; ties of ponderosa pine and white fir did not lose moisture so rapidly (3). Tanoak ties were dried from 100 percent to less than 30 percent in 13 months (June, 1949, to July, 1950). Dried softwood ties were not seriously checked or split, but those left in the yard during the winter were subject to decay. Drying rate and final checking pattern of tanoak ties were not influenced by incising, end-coating, check-bolting, or roofing the stacked ties.

Preservative Treatment: Ties were not injured visibly by treating conditions. Depth of penetration was increased, without excessive retention of treating solution, by initial air pressure and extended pressing time.

Ties of white fir and West Coast hemlock responded to treatment as satisfactorily as did those of Douglas-fir. Penetration of treating solution into heartwood of Sitka spruce and lodgepole pine was limited mainly to summerwood bands. Heartwood of lodgepole pine was difficult to penetrate unless it was incised. Ties of incense cedar and Shasta red fir were penetrated less uniformly than those of other species and also bled more freely after treatment.

Service: Records of ties in service during the last 4 to 10 years have served primarily as inventories of ties in test, although they have indicated some early development of defects due to seasoning and mechanical wear. No decay has been found. About 1.5 percent of ties installed have become unserviceable and have been removed from track.

The condition of ties inspected during 1960 is summarized in Table 3. Large checks, splits, and plate-cutting under the rails were defects that have occurred frequently; few ties were twisted or broken. Ties of Douglas-

Table 1.—VOLUME OF STANDING SAWTIMBER IN WESTERN UNITED STATES OF SPECIES USED FOR EXPERIMENTAL CROSSTIES

Species	Volume[1] Million fbm
Douglas-fir	531,868
Ponderosa pine	224,209
West Coast hemlock	117,497
White fir	65,492
Shasta red fir	36,623
Lodgepole pine	30,051
Sitka spruce	8,839
Mountain hemlock	
Tanoak	2,000[2]

[1] Recent U. S. Forest Service estimates of volume in western United States based in part on data from *Timber Resources for America's Future.* Forest Service, U. S. Department of Agriculture, Forest Resource Report No. 14. 1958.

[2] Graham, R. D. 1954. Seasoning and Preservative Treatment of Tanoak. *Forest Products Journal* vol. IV, no. 2, pp. 92–95.

Table 2.—STRENGTH PROPERTIES OF SPECIES USED FOR EXPERIMENTAL CROSSTIES[1]

Species	Fiber stress at proportional limit: Static bending psi	Compression parallel to grain psi	Side hardness lb	Composite strength[2]
Douglas-fir	7800	5850	710	78
Mountain hemlock[3]	7400	4620	740	74
West Coast hemlock	6800	5340	580	64
California red fir	6300	4220	500	64
Incense cedar	5900	4760	470	61
White fir	6500	3590	440	58
Sitka spruce	6700	4780	510	57
Lodgepole pine	6700	4310	480	56
Ponderosa pine	6300	4060	450	54
Tanoak[4]	6963	4453	1406	--

[1] *Wood Handbook* Agricultural Handbook No. 72, U. S. Dept. of Agri. 1955.

[2] Markwardt, L. J. *Comparative Strength Properties of Woods Grown in the United States.* U. S. Dept. of Agri., Tech. Bul. 158, 39 pp.

[3] Wangaard, F. F. 1950. *The Mechanical Properties of Wood.* John Wiley & Sons, Inc., New York.

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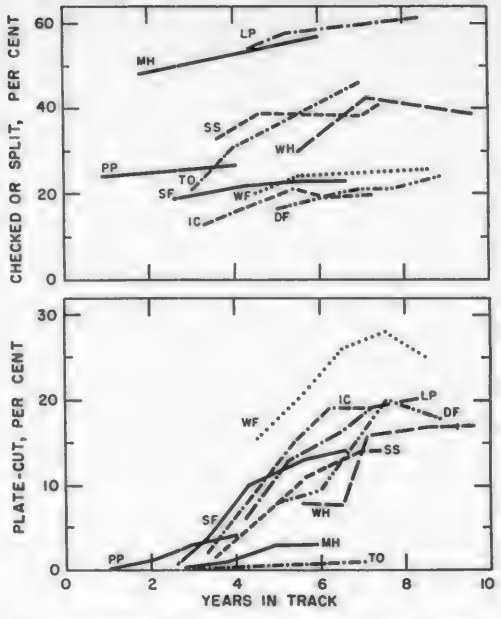

Fig. 2.—Percentages of badly checked or split, and platecut ties of different species of wood during service in test track. Plotted values are average of those from all test locations.

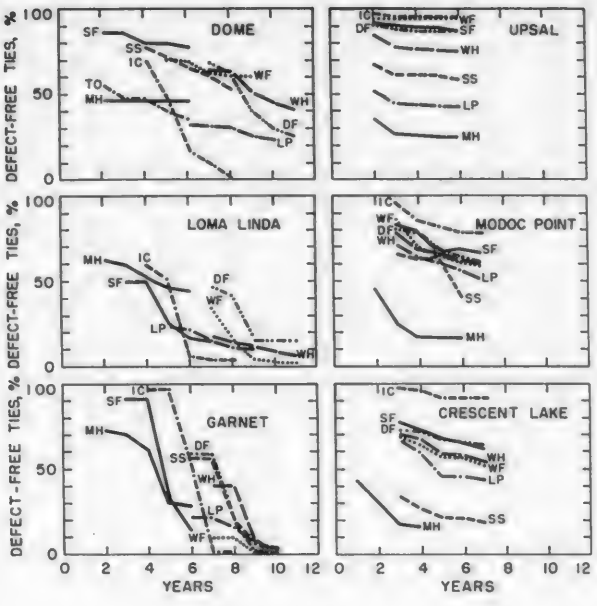

Fig. 3.—Percentage of defect-free ties and years in service in track carrying from 30 to 42 million gross tons annually (to 1956).

fir, incense cedar, Shasta red fir, white fir, and West Coast hemlock have given similar service, in terms of percentages of defect-free ties and renewal of unserviceable ties.

Increase in percentage of ties of various woods that have become checked, split, or plate-cut during service is shown in Figure 2. Ties of mountain hemlock and lodgepole pine probably were checked more severely than were other species when installed and have remained so. Lodgepole pine ties, 95 percent of which contained boxed heart, frequently were checked badly or split. A small percentage of ties of most woods tested became plate-cut after about 3 years of service. Ties of white fir were plate-cut more easily than other woods; those of tanoak and mountain hemlock have resisted plate-cutting. Mountain hemlock ties had greater than average incidence of cross grain and twist.

Decrease in percentage of defect-free ties of various species of woods during service at six test tracks carrying greatest tonnages is shown in Figure 3. Rate at which various defects developed in ties of test species sometimes changed markedly between different track locations. For example, ties of incense cedar performed well at Upsal, Modoc Point, and Crescent Lake, but became defective rapidly at Dome, Loma Linda, and Garnet. Ties of all species have developed defects rapidly at Garnet; similar ties at Modoc Point and Upsal probably will give longer service.

Seasoning checks, often present in new ties, may contribute to eventual failure resulting from splitting, or entrance of decay fungi into untreated wood; however, ties checked before treatment may remain serviceable for many years, then fail for reasons unrelated to checking.

Effects of various defects will be understood more clearly when causes of failure and average service life of test ties are known. Results will provide information on serviceability of Douglas-fir and other western species used for railroad crossties under various conditions of track and climate.

Table 3.—SUMMARY OF CONDITION OF CROSSTIES INSPECTED DURING 1960

Species [1]	Age of ties: Average Yr	Age of ties: Range Yr	Ties in test	Ties renewed [2]: %	Ties renewed [2]: No.	Condition of crossties [4]: No defect [2] %	Badly checked, split [2] %	Plate-cut [2] %	Cross-grained, twisted [2] %	Shattered ends, broken [2] %
IC	7.3	6– 9	1,405	1.2	17	65	20	19	5	0.4
DF	8.8	6–11	2,023 [3]	2.1	42	56	24	18	7	0.4
SF	6.6	6– 7	1,235	1.0	12	64	23	14	3	0.5
WF	8.5	6–11	1,553	2.2	34	52	26	25	2	0.7
MH	5.9	4– 7	1,152	0.4	5	30	55	3	15	0.4
WH	9.5	6–12	1,668	2.6	44	44	39	17	4	0.1
LP	8.2	6–10	1,319	1.1	15	30	61	20	5	0.1
PP	4.0	4– 4	596	0.0	0	68	27	4	4	0.0
SS	7.4	6–10	1,169	1.7	20	45	41	14	5	0.0
TO	7.0	6– 8	187	0.0	0	49	46	0.5	6	1.1
All species			12,307	1.5	189					

[1] IC, incense cedar; DF, Douglas-fir; SF, Shasta red fir; WF, white fir; MH, mountain hemlock; WH, West Coast hemlock: LP, lodgepole pine; PP, ponderosa pine; SS, Sitka spruce; TO, tanoak.

[2] Based on original number of ties in test.

[3] Does not include ties DF 401–500 damaged by derailment at King City milepost 164, 1950.

[4] A tie may be included in more than one category.

Findings also may suggest methods of extending the useful life of ties.

Conclusions

Ties of most coniferous species studied could be air-dried sufficiently for preservative treatment between early spring and following fall. Tanoak ties required about 1 year of drying, but were subject to decay if left in the yard more than one winter.

Ties of white fir and West Coast hemlock responded to treatment as well as those of Douglas-fir; those of Sitka spruce were treated less easily. Penetration of creosote solution into incense cedar and Shasta red fir was erratic. Sapwood of lodgepole pine and tanoak was treated easily, but heartwood was resistant to treatment.

Inspections of ties in service have detected some differences among different species in resistance to mechanical wear and development of seasoning defects; however, because few ties have failed, serviceability of those remaining cannot be predicted now.

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The Author: D. J. Miller received his B. S. in forestry from the University of Connecticut, 1951, and his M. F. from Yale in 1954. He has worked since as wood technologist in wood preservation at the Forest Research Laboratory, Corvallis.

Particle Geometry and Resin Spread:

Its Effect on Thickness and Distribution of Glue-Line in Oak Flakeboard

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The combinations of flake length and thicknesses used in this study encompass those used in commercial operations. They are the ones which appear to deserve investigation from the standpoint of improving certain board properties at the extremes of the particle dimension and resin content ranges common to industrial enterprises.

THE DEVELOPMENT OF FLAKEBOARD presents unique problems to researchers who work with adhesive variables. Two problems associated with most glued construction are 1) continuity and thickness of the glue line and 2) the effects on the strength of the assembly. Optimum glue spreads are usually designated for each adhesive in an attempt to define the thickness of the glue line and to insure proper glue-wood interface actions. Because of the dependence of flakeboard costs on the amounts of resin incorporated, it seemed reasonable to study in some detail the adhesive system of a board which had been subject to intensive study (7)[2]. The urea resin adhesive used had been treated with an ultraviolet sensitive dye (Rhodamine G) to permit examination of the physical makeup of the glue line in order to determine continuity, or lack of it, in the adhesive system. In addition, some effort was made to relate the glue-line thickness and continuity studies to the already defined properties.

There is considerable concurring information (2, 3, 4, 5, 6, 8) that the shape, dimensions, orientation in the product, fiber orientation in the particle, and resin distribution have an important bearing on the mechanical properties and the dimensional stability of particle board. The production variables of press temperature, flakeboard content, and species were held constant in the manufacture of these boards. Resin spread, flake thickness, and flake length had been varied to define optimum board properties as a function of these variables.

Board Manufacture

For the manufacture of the board studied, green scarlet oak pulp bolts, 8 to 10 inches in diameter, and 5 feet long were selected from pulpwood cut

[1] Presented at the 1961 Annual Meeting of the Forest Products Research Society. Louisville, Ky., Session 5 (Division 5, Particle and Fiber Processes A), June 20, 1961.

[2] Numbers in parentheses refer to Literature Cited at the end of this report.

Fig. 1—Flakes 0.025 inches thick with 6.54 grams of adhesive per square meter.

Fig. 3.—Flakes 0.012 inches thick, 0.5 inches long with 13.07 grams of adhesive per square meter.

Fig. 4.—Flakes 0.006 inches thick, 2 inches long with 6.54 grams of adhesive per square meter.

from the Pennsylvania State University woodlands. Those of the best quality available were selected, debarked, sawed in half, and stored under water until flaked. Flaking was performed on a metal-working engine lathe using a 4-inch planer knife and a spur knife for length control.

After a section of the bolt in the lathe had been hand feed cut to a circle, the machine feed was engaged and the bolt cut to a 2.5-inch core. The material thus cut was in the form of long ribbons. Thickness was controlled by selecting the proper feed rate from the large number available. The flakes were placed in rotating wire drums and dried in a kiln at 190° F. to about 4 percent moisture content.

Fig. 2.—Flakes 0.006 inches thick with 3.27 grams of adhesive per square meter.

Handling and tumbling produced chips of most widths desired due to breakage of the cut ribbons, but in a few cases it was necessary to manually break the ribbons for chip formation.

A batch of chips that weighed slightly in excess of the weight needed to form a board of the required specific gravity was placed in a mixer. The batch was tumbled a short time and a moisture content sample taken. The oven-dry weight of the batch was determined and the weight of urea resin required to give the desired percent resin solid was calculated. Resin was applied by a bleeder-type, pressure-feed, paint-spray gun attached to the line by a quick-couple for easy weighing. The urea resin was diluted from 65 percent solids to 50 percent to permit formation of a more finely divided spray.

After resin application, moisture content of the batch was again determined and ranged from 6 to 25 percent. Since it was desired to maintain 10 percent, plus or minus 0.5 percent, at the time of pressing the sprayed flakes were adjusted to correct moisture content by use of a water spray or a cold, dehydrated-air spray.

The weight of chips required to form a board of 0.65 specific gravity (weight and volume O.D.) was calculated and weighed. The board was formed by hand in a 10- by 10-inch caul box about 5 inches deep. The mat was prepressed in a gluing clamp if necessary to reduce it to available press opening size. The caul box was fitted inside a preheated steel frame and the whole assembly placed in the hot press, which was closed as rapidly as possible to 0.75 inches. Curing time was 15 minutes at 275° F.

Finished boards contained 3.25, 6.54, and 13.07 grams of resin solids per square meter. (The resin spread corresponding to Turner's [8] 1 by 3 by 0.018 inch flakes at 4 percent resin is 3.27 grams per square meter of surface area). Panels were composed of flakes having thicknesses of 0.006, 0.012, 0.025, and 0.050 inch and flake lengths of 0.5, 1, 2, and 4 inches. These variables resulted in a design which was easily subjected to statistical treatment.

Procedure

A 0.5- by 0.5-inch block was cut from each board and smoothed on two

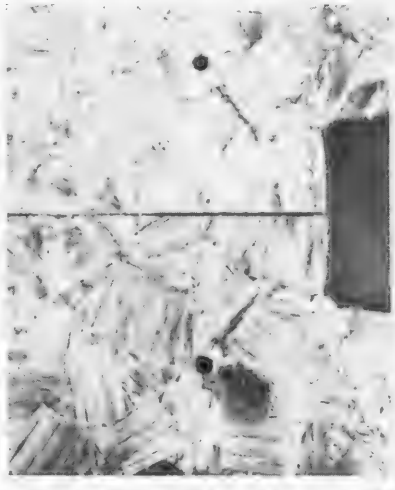

Fig. 5.—Flakes 0.012 inches thick, 0.5 inches long with 6.54 grams of adhesive per square meter.

Table 1.—MEAN THICKNESS OF ADHESIVES ($\times 10^{-3}$) inches[1]

Flake Length	Resin Spread 3.27 gm/m²				6.54 gm/m²				13.07 gm/m²			
	Flake Thickness ($\times 10^{-3}$) Inches											
	6	12	25	50	6	12	25	50	6	12	25	50
0.5"	3.07	3.29	4.25	2.81	3.96	5.22	4.68	3.13	3.74	9.30	5.91	3.74
1.0"	2.58	4.52	2.76	2.56	2.34	6.15	2.93	2.73	3.94	7.04	5.44	3.20
2.0"	3.00	3.61	4.08	3.35	3.37	4.77	3.20	3.40	3.13	4.85	4.48	2.85
4.0"	5.65	6.03	2.95	3.08	8.64	4.87	3.84	4.77	7.63	6.35	6.77	4.87

[1]Original measurements in microns.

opposite sides by passing the block through a rotating diamond blade so that the flake edges were visible on the parallel faces. One parallel face of the block was placed on the stage of an incident light microscope and examined under ultraviolet light. It was at this time that the continuity of the adhesive system was observed. Figures 1 and 2, taken at about 70 magnifications, illustrate what is considered to be a practically continuous adhesive system in this board although the black-and-white reproduction of the colored photographs does not give too satisfactory an illustration of this point.

Higher magnification study indicated that the glue lines were clearly defined between flake edges and 1,600 random thickness measurements were made by ocular scale of glue lines in randomly selected samples of each board variable. The mean thicknesses of adhesive are given in Table 1. An analysis of variance was calculated to define the differences which might exist between the glue-line thicknesses. The results of this analysis are shown in Table 2.

Since all treatment levels were chosen by consideration rather than at random, the experiment analysis is based on a linear hypothesis, or fixed effects model, for the analysis of variance. The significance of the second order interaction, flake thickness times length at the 5-percent level places the additivity of the data open to question. Therefore, the analyses were broken down to flake length and one analysis was calculated for each flake-length series. These are shown in Table 3. Tukey's test was used for mean separation and the results are shown in Table 4.

Since the edge sections had shown what appeared to be a continuous adhesive system, the remainder of each sample was split apart and the adhesive-wood combination examined under the ultraviolet light microscope. The presence of the florescent dye on whole areas of chip surface indicated that the adhesive was distributed completely over these areas during the manufacturing process. Wood failure indicated those areas where the adhesive could be considered to have performed efficiently, particularly complete failure of many of the chips mechanically broken during the splitting of the board. The symmetry in figures 3, 4, and 5 shows this mechanical breaking of the chips, where the wood failure is indicated by the presence of mirror-image flakes on both sides of the split. Again, unfortunately, the black-and-white copies of the color prints do not show the florescent material completely covering all of the particles except the split flakes.

Figures 3, 4, and 5 show a noticeable lack of adhesive droplet distribution which has been noted during many other investigations. These figures show wood failure in a spot distribution to be unusual rather than common, while complete chip failure could be described as the normal method of board failure when the material is split in this manner. However, the large amount of florescent dye indicating adhesive distribution which occurred where there was no evidence of bonding raised the question as to whether this was a true

Table 2.—ANALYSIS OF VARIANCE

Source of Variation	Degrees of Freedom	Sum of Squares x 10^{-9}	Mean Square x 10^{-9}	F
Spread	2	133627	66813	12.34[1]
Thickness	3	177702	59234	10.95[1]
Length	3	149630	49876	9.22[1]
S x T	6	48790	8131	1.50
S x L	6	33870	5645	1.04
T x L	9	165870	18430	3.40[2]
T x L x S	18	97413	5412	
Total	47	806902		

[1]Significant to the 1.0% level.
[2]Significant to the 5.0% level.

Table 3.—ANALYSIS OF VARIANCE, O.5-INCH LENGTH FLAKE

Source of Variation	Degrees of Freedom	Sum of Square x 10^{-9}	Mean Square x 10^{-9}	F
Spread	2	90934	45467	4.12
Thickness	3	70292	234306	2.12
S x T	6	66164	110273	
Total	11	227390		
1.0" length flake				
Spread	2	117900	58950	22.71[1]
Thickness	3	45394	15131	5.83[3]
S x T	6	15577	2596	
Total	11	178871		
2.0" length flake				
Spread	2	21104	10552	5.26[2]
Thickness	3	1274	425	0.21
S x T	6	12023	2004	
Total	11	34401		
4.0" length flake				
Spread	2	113635	56818	6.63[3]
Thickness	3	50536	16845	1.96
S x T	6	51402	8567	
Total	11	215573		

[1]Significant at 1.0% level, F > 10.92.
[2]Significant at 5.0% level, F > 5.14.
[3]Significant at 5.0% level, F > 4.76.

representation of the adhesive distribution or just of the dye used for florescent work. Figures 6 and 7 show the results of distribution tests on filter paper with the same adhesive as originally placed in the board. Although a large amount of the solids of the adhesives remain in a central area of the filter paper deposit (light), it was noted that the area to the extreme distribution of the florescent dye (dark) also has a stiff texture and a shiny surface, verifying the fact that some portion of the adhesive is carried with the florescent material to the extremes of its distribution. Manual flexure tests of the edges of these adhesive deposits verified that adhesive is present wherever there is any dye present. Due to the similarity of the fibers in the filter paper to wood, it was concluded that the dye in the adhesive system goes no farther than the adhesive. Bosshard and Plath (1) have studied the adhesive distribution in particle board using florescent dye but have not verified the distributions of each by any such method as this filter paper test.

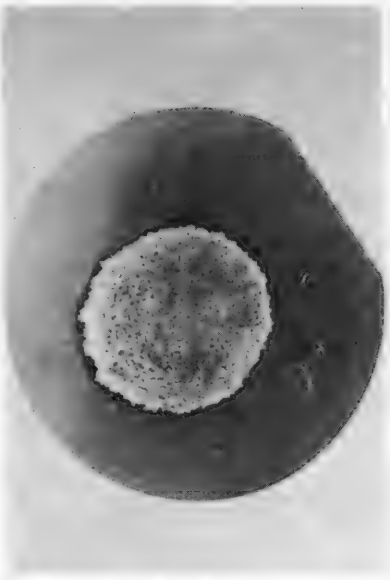

Fig. 6.—Cured urea formaldehyde resin originally placed on wet filter paper.

Fig. 7.—Cured urea formaldehyde resin originally placed on dry filter paper.

Results and Conclusions

The flake-length analyses show that with half-inch flakes, the adhesive spread and flake thickness do not significantly affect the glue-line thickness. Apparently closer contact of the flakes is obtained than in the longer particles under all spread conditions, and the squeezed-out adhesive in the heavier spreads becomes a gap filler. With this flake length, a small amount of extra stiffness may be derived from heavier resin spreads but no additional strength will result. At the other three flake lengths the spread significantly affects the glue-line thickness. Apparently as length increases, the overlap problem does not permit close contact of the particles, although the reason for this is not thoroughly understood with flakes of only 0.006-inch thickness.

In the original analysis it will be noted that spread has a significant effect on glue-line thickness. However, examination of the means showed that the medium spread mean does not differ significantly from the low-spread mean and the significantly thicker glue line occurs only with the higher spread. This correlates very closely with the original modulus of rupture data found for this board by Post (7) where there was no difference between low and medium spread board strength and a slight increase in strength at the high spread.

Further attempts to define empirically the nature of the glue-line thicknesses and adhesive system relationships with the original strength data for this board were largely unsuccessful. These data show glue-line thicknesses for various particle surface areas and provide a background for selecting any resin spread to produce what the investigator could consider an optimum glue-line thickness.

It is hoped these data will be of value in future particleboard work where close control of adhesive thickness and distribution is required.

Table 4.—MEAN SEPARATION TESTS

Spread	$P_1 = P_2$	P_1 not = to P_3, P_2 not = to P_3
Length	$L_3 = L_4$, $L_1 = L_3$, $L_1 = L_2$ $L_2 = L_3$	L_3 not = to L_4, L_2 not = to L_4
Thickness	$T_3 = T_4$, $T_1 = T_4$, $T_3 = T_1$	T_3 not = to T_1, T_2 not = to T_1 T_2 not = to T_3

Where P_1, P_2, P_3 are the mean thickness of the glue line at 3.27, 6.54, and 13.07 grams per square meter respectively.
L_1, L_2, L_3, and L_4 are the mean thickness of glue lines at 0.5, 1, 2, and 4 inches respectively.
T_1, T_2, T_3 and T_4 are the mean thickness of the glue line at 0.006, 0.012, 0.025, and 0.050 inches respectively.

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The Interrelation of Government and Private Research

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This article was originally prepared by the author as an address to the technical staff of the U. S. Forest Products Laboratory, Madison, Wis. It is a thoughtful analysis of a problem that has basic significance throughout the forest products industries and for all who are active in research, whether privately or publicly financed.

ONE OF THE BEST WAYS TO DIFFERENTIATE between two activities is to know and understand their respective objectives. We should begin by inquiring into the whys and wherefores of the objectives. I can assure you that the importance of this matter goes deeply into the research organization, clear through to the individual staff members of whom the organization is composed.

Why do you and I work? Why do we work at all? There are three reasons, and I think only three:

1. To have enough money to procure the necessities and some of the luxuries—those luxuries we care most about.
2. To have the opportunity to advance in our chosen calling, to climb toward the top of our respective organization.
3. To have the opportunity to pursue happiness and seek satisfaction—to accomplish something interesting and worthwhile.

Stated very briefly, then, we work for money, for future advancement, and for satisfaction, namely down-deep fun.

To work toward an objective can be the source of great personal enjoyment. It is in the reaching of an objective, previously set, that the professional man derives his deepest feeling of satisfaction. This is a guaranteed cure for frustration, an affliction all too common in industrial organizations. With a specific objective on the horizon, the job becomes a game, a contest between each of us and what a physicist friend of mine once called "the innate perversity of inanimate objects."

Objectives

I have been most fortunate in much of my professional career in having definite objectives toward which to work and in being in a position to observe how valuable they are. Mr. J. P. Weyerhaeuser, Jr., provided an objective for his company that was perfectly simple and tremendously effective. It was: "To produce the best diversified products of highest value, through complete integrated utilization of the best tree crop we can grow, in the allotted time."

At the time this objective was set up in 1945, his company had two lines of business, lumber and sulfite pulp. You are all aware of what happened in the decade from 1945 to 1955. Every member of his team knew what the chief wanted and did his part. This performance was a source of constant satisfaction to all of us and still is to me personally.

If I have learned anything in my contacts of the last six years as a consultant in the field of setting up "Development Programs for Industry," it is the importance of visualizing and deciding where one wants to be at some particular time in the future. It is not sufficient to say we want to do a better job for our customers, our employees, our shareholders, or our communities. Some guide lines must be set up, and specifics must be stated. And above all, we must understand what certain words mean.

There is confusion in high places with respect to the meanings of the words objective, scope, justification, plan. An objective has nothing to do with the present except as a starting point. An objective defines a destination, something that lies in the future. An objective is not the size of the field in which we expect to work, nor is it the approach we propose to use, nor is it the reasons why the work should be done. It is the place at which we expect to arrive or the condition we expect to enjoy at some future time. The big book in my library that has so many enlightening statements in it says: "An objective is a strategic position to be attained."

There is considerable reluctance on the part of some top managements to formulate an objective in simple but specific terms and post it where all may be inspired by it.

In my experience, it is only upon rare occasions that anything of consequence is accomplished by accident. Of course, there are alleged examples of accidental discoveries, but whether they are adequately documented as achievements by pure chance and chance alone, I do not know. Consid-

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ering the tremendous areas of which we have little or no knowledge, I'm sure mathematicians would tell us that for an annual national expenditure of 12 billion dollars for research we could not very well miss entirely the accidental acquisition of some choice morsels of new knoweldge. But in any event, I reject the premise that my future can be satisfactorily served by a game of chance.

Remember, we are trying to explore what the differences are, or should be, between Government and private research. Which phases of research should be the main concern of industry and which the main concern of Government? I think you will shortly see what objectives have to do with these questions.

If you agree that our future existence depends upon the application of logic and not the absence of it, then I think we have found a means to divide the great field of research into two very different parts; that part which is actuated by striving to reach a useful objective in the foreseeable future; and that which is actuated by striving to acquire new knowledge without regard to its utility, immediate or otherwise. The latter, I think, has been called fundamental research, but this term has been used so loosely by so many that I prefer to call it abstract research. One writer has called it unfettered research. It is characterized by an indefinite objective, if any, a considerable faith that the findings will ultimately be useful, and plenty of time in which to pursue the work. In short, it is research for research's sake.

Types of Research

One can point out plenty of examples of the results of abstract research that ultimately became very valuable. I suspect the mathematicians were building up their stock of knowledge long before Operations Research came along to help guide the strategy of World War II. I further suspect that later on furnishing management with the alternative answers to its problems had hardly been an objective of the original mathematical research. So certainly no open-minded person can oppose abstract research, but there appear to be few competent self-sparkers who can do these things. When we find one, we should put him in the right environment, give him a drawing account, and hope for the best. These abstract research men do not belong in industry and it is a mistake to put them there. Research in industry is inevitably tied into the company objective and company objectives inevitably deal with earnings. In very prosperous times this might appear not to be so, but just let the earnings fall off and you will see how quickly the environment can change.

Industrial research must try to achieve its predetermined objectives at an agreed upon cost within an agreed upon time. This is not the environment in which the frontiers of knowledge are pushed back with little thought of practical utility, that is, knowledge for knowledge sake.

Now let us spend a few minutes describing or defining the other category of research generally termed "applied." I shall call this commercialization research merely to emphasize that the objective is always to achieve commercialization. Abstract research may have no definite objective; commercialization research always has a very definite objective. Charles Allen Thomas of Monsanto Chemical Company during a recent address gave out this pertinent sentence: "It has become clear that at the present stage of research only the objectives separate the men in basic research from the men in applied research. They are equally well trained and use the same techniques."

But there is still a missing link in our classification, an inbetween kind of research that retains the objective as a characteristic but at the same time seeks immediately useful new knowledge. This in the past has gone by various names. The president of a prominent research institution recently called it "directed basic research" and defined it as "a quest for new knowledge conducted with a sense of urgency." The National Science Foundation, in its definition of basic research, includes the proviso that "the field may have present or potential interest to the company" even though specific commercial objectives are missing. Present industrial practice is gravitating toward exploratory or pioneering research as good descriptive terms.

Now I think there cannot be any confusion about these three research names I've used, but to sum up:

Abstract research is unfettered searching for new knowledge for knowledge's sake.

Exploratory research is planned searching for new knowledge to achieve commercial progress beyond the limitations of present knowledge.

Commercialization research is planned application of the most practical known technology, the soundest known economics and the best timing for a particular job.

With these three yardsticks to guide our digging, in what area do we find Government active and in what areas, industry; and as someone said to me, "Are these roles as they should be?"

Let's spend a few minutes looking at Government objectives as disclosed by the record. First let's see what Congress says. The Research and Marketinfi Act of 1946 which established the Advisory Committee System for the Department of Agriculture, gives its objective thus: "to assure agriculture a position in research equal to that of industry."

That is about as definitive as the famous remark of Calvin Coolidge when asked what the preacher had talked about one Sunday morning. Mr. Coolidge said the preacher was unquestionably opposed to sin.

Next, what does the Agricultural Research Policy Committee itself, which rides herd on the Advisory Committees, say? In its 1958 report there are these two interesting statements:

1. "Basic Research is the exploration of the unknown to develop new and original approaches to agricultural problems." This is clearly exploratory research.

2. "Scientific investigation is limited only by the imaginative thinking of well-trained men without pressure for application or use." If I have caught the meaning, this is clearly abstract research.

Third, now let's see what a committee of outsiders had to say specifically about forest products research objectives. This is taken verbatim from the report of the Task Group on Forest Products, of the President's Commission on Increased Use of Agricultural Products.

1. To reduce waste in harvesting and primary utilization. This is commercialization.

2. To find industrial uses for those parts of the forest crop not now economically useful. This is exploratory as written.

3. To expand and improve the serviceability of forest products. That is commercialization.

As a good example of how the choice of one word changes the kind of research, under objective 2 the verb "to find" means "to explore." Had the verb been "to achieve," it would mean "to commercialize." Having been a member of this Task Group, of course, I know we meant exactly what we said: "to find . . ."

Fourth, let's look at what you yourselves wrote in the report entitled "Research Needs in Agriculture," more commonly called the CORE report.

Early in the report this statement is made: "To function most effec-

tively, research should seek to attain the following objectives," and then 16 objectives are recorded. No doubt all of you have studied these at some time—the report was released 4 years ago. I do not intend to take up time discussing this report except as it contributes to clarification of this business of Government research objectives.

A bona fide objective always begins with the little word "to," to arrive at some goal. Now let's see how these CORE objectives stack up.

"To study" is used in one.
"To increase knowledge" is used in two.
"To discover, identify, measure" is used three times.
"To develop means, practices, methods" is used six times.
"To appraise" is used three times.
"To determine" is used four times.
"To provide guides or statistics," six times.
"To undertake," once.
"To be cognizant of," once.
"To increase efficiency of," once.

We have a total of 28 "to-do-something" infinitives because some of the 16 objectives are doubles. You will recognize those which have to do with pioneering or exploring, as these: "To study," "to increase knowledge," "to discover." They're used a total of six times out of 28; that's 20 percent.

The remaining 22 all appear to be in the applied field; that is, in general headed toward the commercialization of new or improved things, to insure the future growth and welfare of the United States. Now I said they "appear to be in the applied field" because there seems to be a missing link between such objectives as "to develop," "to determine," "to undertake," and the open and shut objective "to commercialize." One of the 28 reads: "To increase efficiency in the production, processing and marketing of farm and forest products by reducing loss and waste and by developing technological and managerial improvements."

Commercialization

There can be no doubt but that that objective is to commercialize. Now how shall we honestly categorize the other 21? They are directed toward the procurement of tools and techniques which are needed, hence may be said to be stages in conducting commercialization research. One can reach an objective expressed as "to develop means" or "to discover values" without too much trouble; but to commercialize these things is a quite different and more difficult undertaking.

Perhaps it will be argued that it is not the business of federal research agencies actually to commercialize, but that can hardly be accepted in view of all the demonstration farms and forests and the extension courses and field services that have been active for a long time.

You are probably wondering by this time what I am going to do about the objective of the Forest Products Laboratory. I would put it this way: way. "To promote better, more efficient, and more diversified utilization of forest raw material, through the improvement of the harvest, the processes, the finishes, and the serviceability of the end products."

I think that is a fine objective. I have just one comment and this is, the phrase "to promote" might be changed to the phrase "to achieve." This would make it clearer to the team that the job actually isn't finished until this better, more efficient, and more diversified utilization is put into practice.

Conclusions

Now we have analyzed at least a part of the record on the objectives of government research, so what may we conclude?

Abstract Research: Abstract research, seeking knowledge for the sake of knowledge, has no place in industry. Industry is a rough-and-tumble competitive battle, no quarter asked and none given, and it is no place for any activity that may or may not be useful. So when a real genius in the area of generating new knowledge shows up, one of the universities or one of the government organizations, such as the U. S. Forest Products Laboratory, should provide him with the opportunity and the encouragement to carry on his studies.

Exploratory Research: In the field of exploratory research, seeking new knowledge to solve existing problems, industry if government laboratories would take over this area entirely. There is so very much to be done, however, that this appears quite impractical. Both public and private money are needed, and somehow objectives should be arranged so overlapping is minimized, if that be possible. It seems to me this is not so much a matter of having used up our knowledge as it is of never having had it in the first place, and I hasten to differentiate very decidely between factual knowledge and opinion. Factual knowledge results from the planned experimental determination of effects, provided by the controlled manipulation of the independent variables, measured by adequate methods, and expressed by numbers. Opinions are personal impressions, gathered perhaps over a long period of time. Facts result from hard work; opinions are not so hard to come by. The trouble is that a strange metamorphosis sometimes take place: opinions gradually become accepted as facts. Against this, we must constantly be on our guard.

So, government and industry are equally concerned with exploratory research, and each must give it a prominent place in the program if objectives are to be reached. However, there is one type of exploratory research which I think is peculiarly the function of government, and I recommend this especially to my friends in the Laboratory. This is the recognition and use of new technology, new tools, new techniques, newly discovered laws, new logic, new approaches, and the prompt application of these to the fields of mutual interest—particularly forest products—because these control the income of industry, which in turn makes a major contribution to the economy of the country.

Industrial Knowledge: The facts of science and engineering are growing at a frightening rate, and some means must be provided for industry men to receive at more or less regular intervals large doses of sugar-coated new knowledge. I recommend a new position in the Forest Products Laboratory: A Director of Technical Intelligence.

I quote—"The great Bell Laboratories biggest job is said to be keeping the parent company abreast of the latest scientific knowledge in all the fields it is interested in."

Now we have drawn conclusions relative to the terms "abstract" and "exploratory" as they pertain to research. Let's get back to applied research, that which is dedicated to commercialization, and see what conclusions we might agree upon as to the roles of government versus industry. I have letters in my files voicing strenuous objection to the U. S. Government's doing applied research, saying that this is solely the business of industry. If that be so, I would say there is nothing stopping industry from taking over the job 100 percent except industry's own lack of initiative. I sometimes use this expression to alert people to what's needed: "You can't get the answer to the problem if you don't want to change anything!"

Project Commercialization: To commercialize a project I hope you will agree that you should concern yourself with markets, economics, pilot operations, engineering design, and statements of projected earnings. These activities used to be conspicuous by

their absence in forest products research, but thanks to the foresight of certain U. S. Department of Agriculture and Forest Service executives we see these activities gradually taking their rightful place. When they do, FPL will have a green light for all the commercialization research its budget will stand and still be in balance with other demands.

I see no good reason for either industry or government trying to put the other in a corral identified as some particular kind of research. I have an answer for those who argue that FPL should do no commercialization research. If you owned 186,000,000 acres of forests as Uncle Sam does, a lot of which is currently worthless for material products, and if you were charged by the Congress with the best possible management of this resource, would you or would you not have a research organization conducting commercialization research? The answer is, I certainly would!

I would like to talk a little more about this commercialization angle. An arrangement has been available for industry-government cooperation in research at the Forest Products Laboratory since before my time—and that was over 30 years ago. A means of joint commercialization was required, and these cooperative projects constituted that means. Any procedure that lasts for 30 years must be pretty good. I'm sure many commercial objectives have been reached which otherwise would not have been attained. I will give you one example.

Some 8 or 9 years ago, the company with which I was connected came to the Laboratory to seek help in improving the performance of western hemlock bevel siding relative to cupping, splitting, and paint blistering. After exploring a number of approaches, we finally decided to concentrate on water-repellent treatment. Besides finding that the treatment reduces the instability troubles greatly, we uncovered or confirmed the great effect which rain has on paint blistering and the absolute necessity that an exterior paint for wood be designed for strong and lasting adhesion in the presence of liquid water at the interface. These findings have been of great value both to individual companies and their trade association. It is greatly to be regretted that some big-name paint companies have not acted on these research findings and come up with paints designed to meet the need.

A project of this kind, dealing with markets, uses, requirements, product performance, and so on, all in the merchandising area where publicity is most desired, seldom encounters trouble from the old stumbling block in cooperative research agreements involving right to publish, ownership of inventions, and prosecution of patents, as sometimes happens in the manufacturing area. I hope your cooperative projects will grow to be a major part of your programs. And finally, this leads to several suggestions I wish to make in closing.

The Keystone of Success: First, both industry and government have paid insufficient attention to the requirements of use, the keystone of success in the market place. The requirements of use control the property values of the product; these control its satisfactory performance, hence its price level versus competition; hence its value, performance versus price; and finally its very business existence.

Having spent many years studying requirements of use, I am particularly sensitive to the shortcomings of almost everything we as consumers buy and use. The situation shows that those really responsible for the performance of a product, the scientists, engineers, designers, and last but not least, top management, simply aren't giving this the attention it merits. To understand requirements of use and incorporate adequate values for the properties required to comply with the requirements necessitates a high degree of mental labor. And laboring mentally is not a particularly popular pastime.

As a corollary to this situation, I cannot refrain from calling your attention to the misleading nature of some contemporary product promotion. We are living in the era of "the fast buck." The Federal Trade Commission is the official inspector charged with the tremendous job of checking the bets and keeping the game honest. I suggest that the Commission's monitors might gain deeper insight into what constitutes misleading advertising of products in this category if they knew about and understood the use requirements as established by FPL research and long-time experience of the lumber, construction, and related industries. Who is in a better position to say what the requirements of use are and how well various kinds of products meet these requirements than FPL?

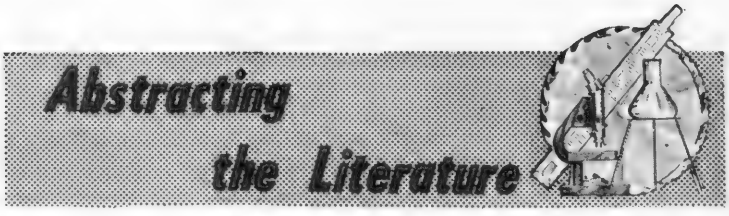
Lastly, the forest products industry and the Forest Products Laboratory have a huge job to do to sell wood to the consumer, and if we don't get on with it pretty quick, we won't need to worry about it. The argument about whether we will have enough wood in the year 2,000 will settle itself. We'll have plenty because there won't be much used. The consumption of certain well-known patterns made from the finest wood in the tree whose property values meet more of the requirements of use by far than those of any competitive product on the market has dropped steadily over the last 5 years by a substantial percentage. Why is this, and what must we do?

I said we have to sell wood to the consumer. You say, why, everyone knows about wood! Everyone used to know about wood—your father and your grandfather, and mine. But new generations come along who do not know wood. They are rapidly coming to live in a synthetic world. The old proven staples—cotton, wool, leather, wood—are on the way out. There is a trend away from traditional and conventional things, a disregard of the facts of performance as called for by the requirements of use—and sometimes, I fear, too much desire for temporary saving of a few pennies.

The Gospel of Wood: We have the job of spreading the gospel of the performance of wood. We have ample ammunition for the purpose. All we have to do is tell the story in shirtsleeve English so the guy in the street can understand it, and then see that he reads it. Take the facts of handleability, of workability, of versatility, of ruggedness, of durability, the benefits of grain, the benefits of hygroscopicity, the benefits of instability (this is not a typographical error), the tremendous paintability, the thermal resistance, and so on and so on. Some things we must stop doing. We have to stop using grade names that are meaningless to the layman. We have to see to it that we deliver to the job the quality that the use demands and the consumer pays for. We must get on with the job of gluing up lumber into the exact lengths and widths the use demands; get on with the job of panelization. The competitors of wood, as F. K. Weyerhaeuser observed in an address at the golden anniversary of FPL last year, are skillful innovators and promoters. The end justifies the means so far as they are concerned, and the end they are interested in is all of the market.

The competitors are financially able to do research, financially able to capitalize on consumer advertising, and financially able to convince the consumer he should buy a product whether it satisfies the requirements of use or not and whether its price is in line with its performance or not.

Maybe we should all take a fresh look at forest products and follow Mr. Kennedy's advice to set up a new frontier of our own. You need industry's help, and industry needs your help. We must all hang together, or assuredly we shall all hang separately. The handwriting is on the wall.



WOOD—SUPPLY AND PREPARATION

EXTRANEOUS MATERIALS

Schopmeyer, C. S., and Maloy, Otis, C. Dry face of naval stores pines. [U.S. Forest Serv., Forest Pest Leaflet 51]. Washington, U.S. Govt. Print. Off., Dec., 1960. 7 p.

"Dry face" is a condition involving permanent cessation of gum flow from part or all of the normally active turpentine face of a tree. Where trees are not harvested promptly after completion of turpentining, these dry areas are frequently attacked by insects and fungi, causing staining and decay. Among the two com. naval stores pines in the U.S.A., slash pine *(Pinus elliottii)* is more subject to dry face than is longleaf pine *(P. palustris)*. Symptoms and predisposing factors are described. Although symptoms were induced exptl. during a dry season in wood-chipped slash pines by inoculation with several fungi, no fungus has been proved to be a primary cause of dry face. Preventive and control measures are largely equiv. to good management and turpentining practices. Two changes in gum extn. techniques during the past decade have greatly reduced the incidence of dry face, viz., the use of bark chipping with acid trmt. instead of wood chipping, and the use of nailed instead of inserted gutters. 8 ref.

PROPERTIES

BOYCE, STEPHEN G., and KAEISER, MARGARET. Environmental and genetic variability in the length of fibers of eastern cottonwood. Tappi 44, no. 5: 363–6 (May, 1961).

The mean length of fibers among 83 trees of *Populus deltoides* at 4.5 ft. from the ground ranged from 0.85 to 1.28 mm. The no. of annual rings and the diam. accounted for at least 50% of the variation. The genetic variance was estd. to be *ca.* 30%. The max. av. fiber length that can be expected after several generations of selection was estd. to be less than 2.0 mm. for trees 18 in. in diam. at 20 yr. of age. The results of this study can be used to identify trees with fibers inherently longer than the av. for natural trees. 15 ref.

SCHORNING, PAUL. Investigations on the hydrolysis and prehydrolysis of woods, especially in organic-aqueous media. Faserforsch. u. Textiltech. 12, no. 2: 49–55 (Feb., 1961). [Ger.; Russ. and Engl. sum.]

Beechwood chips and sawdust were hydrolyzed at reflux temp. and at 20 and 60°C., resp., with dil. (2–3%) hydrochloric acid solns. in water (regarded as an unsubstituted alc.), methanol, ethanol, *n*-propanol, or 2-propanol. The effects of the medium, of various additives (salts, inorg. acids, formaldehyde, etc.) and of temp. were studied. Hydrolysis and delignification increased with increasing chain length of the alc., as did the intensity of the red-brown coloration of the hydrolyzates, whereby 2-propanol occupied a position between ethanol and *n*-propanol. Sodium chloride exerted a significant catalytic effect, permitting the hydrolysis time to be shortened from 5 to 3 hr., whereas magnesium chloride, sodium nitrate, sodium sulfide, ferrous sulfide, and other salts had no appreciable effect, and sodium sulfate showed a retarding action. Formaldehyde acted as an inhibitor in the presence or absence of sodium chloride, probably because of its cross-linking effect on cellulose. Hence formaldehyde addns. in the prehydrolysis-sulfate process could be valuable in minimizing cellulose losses. All hydrolyzates contained lignin-carbohydrate complexes, from which the xylan-type moieties could be sepd. by a post-hydrolysis trmt. to give a residue of typical phenylpropane structural units. It is suggested that the lignin in the hydrolyzate complexes is present as alcohol-lignin, and that the alcoholysis of wood prior to alk. pressure trmt. may offer a new pract. way of obtaining phenolic and other aromatic cpds. from lignin and lignin-contg. wastes. 12 ref.

SUNLEY, J. G. and LAVERS, GWENDOLINE M. Variations in the strength and specific gravity of Sitka spruce grown in Great Britain. J. Inst. Wood Sci. no. 7: 15–27 (April, 1961).

Sitka spruce, widely used in afforestation by the Brit. Forestry Commission, is known to show considerable variations in quality, the causes of which are not fully known. Variations in strength and sp. gr. have been measured and related to the different

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SOURCES OF FPRS ABSTRACTS

The preparation of abstracts from world literature in many languages is so highly specialized and costly that the Forest Products Research Society has no abstracting service of its own. For the abstracts in this issue of the *JOURNAL* the Society is indebted to the respective abstract journals indicated, from which they have been selected with the kind permission of the editors. Readers wishing information in addition to that given in these abstracts should consult the original articles referred to. Copies or additional information cannot be supplied by FPRS or the abstract journal. The journals from which abstracts are published in this issue are as follows:

BULLETIN OF THE INSTITUTE OF PAPER CHEMISTRY, published monthly at Appleton, Wisconsin by the Institute of Paper Chemistry. Photostats and/or translations are available at reasonable cost from the Institute.

geographical regions and site factors. The results indicate that the region of growth has a small effect, with large variations occurring between trees on the same site, although between-site and within-tree variations cannot be neglected. In addn. the relation between the "Quality Class" of the site and the props. of the wood is examd., and the possibility of using tree girth in estg. timber props. is discussed.

PAPER AND BOARD

LIIRI, OSMO, and HAAVISTO, SIMO. Some problems with the use of wood-particle board. Paperi ja Puu 43, no. 4a: 219–21, 224–6, 228–30 (Special issue, 1961). [Finn.; Engl. sum.]

In a comparison of several types of particle-board joints, the ordinary butt joint as a joint in the plane of the board and the mitre joint as an angle joint were found to be the best joints for wood-particle boards. These joints can be given a loose tongue or dowels, mainly as guides but also to improve the strength of the joints. In a study of the screw-holding power of particle boards, drilling was found to be the best way of making the pilot hole. The hole should have a diam. slightly less than the inner diam. of the screw thread and a length about two thirds that of the threaded part of the screw. Insertion of a screw can be started with a hammer, but at least one half of its length requires fixing with a screw driver. Dipping the screw in glue before insertion is rel. unimportant but does improve the screw strength in the plane of the board by *ca.* 10%. The screw-holding power of particle board gen. grows with the screw length. It was 20% greater for special particle-board screws than for ordinary wood screws parallel to the plane of the board, but roughly the same for all screws tested perpendicular to the board plane.

Kumar, Vidya Bhushan. Recent studies on oil-tempered wood-fiber boards. Holz Roh- u. Werkstoff 19, no. 1: 15–20 (Jan., 1961). [Ger.; Engl. sum.]

Factors affecting the quality of oil-tempered hardboard and variables of the mfg. process are discussed. The quality of the pressed sheet has a decisive influence on the props. of the finished board. The bending strength of the sheet affects the percentage of oil absorbed. The use of catalysts can significantly improve the strength of the boards. The rougher wire side lends itself better to lamination than does the smoother side; however, polishing enhances the gluability of the smooth side. 5 ref.

Thorbjornsen, Eyvind. Variation in density and fiber length in wood of yellow poplar. Tappi 44, no. 3: 192–5 (March, 1961).

A study was conducted to det. if differences in wood props. among yellow-poplars *(Liriodendron tulipifera)* in east Tennessee and southeast Kentucky were large enough to encourage a breeding program based on individual tree selection. Data from 10 stands and 63 individual trees were included in the study. The d. increased from the inner core to the outer wood; at 5 yr. the av. was 0.42 g./cc., at 15 yr. 0.45, and at 25 yr. 0.46. Results from extn. with alc.-benzene indicate that the main difference between sapwood and heartwood is due to the stains present in the heartwod. On an av. 2.5% of the dry matter was removed in the extn. process; this amt. did not vary in the radial direction. The component of the total variation in d. which the individuals account for is large, being about 70%. Rel. rapid improvement will probably be made by selection for high d. due to the large individual tree variation and a good relationship between core wood and mature wood ($r = 0.731$). During the first few yr. of growth there is a marked increase in fiber length which tends to level off in later yr. Differences among trees with short and long fibers are large, but the anal. of variance indicates that they are not significant due to a large within-tree variance component. This within-tree component can be reduced by measuring a larger no. of fibers and taking more care in sampling the same portion of a given annual ring. 6 ref.

Ziegler, Hubert, and Merz, Walter. "Hazel" growth; relationships between irregular [cambial] thickness growth and distribution of wood rays. Holz Roh- u. Werkstoff 19, no. 1: 1–8 (Jan., 1961). [Ger.; Engl. sum.]

A thorough anatomical study of "hazel" wood (gnarled or burled wood) and related morphopathol. phenomena (knots, snags, wavy grain) in various sp. *(Picea abies, Pinus jeffreyi,* and *Salix viminalis*) indicated these abnormalities to be due to local disturbances in the growth of the cambium causing lenticular recesses in the contours of the annual rings. In the disturbed regions, the wood rays are 40–50% more frequent and 15–20% greater in vol. than in normal growth regions, and the no. of cells in tangential sections of a ray is 10–20% lower. Causal connections between the distributed ray distribution and the abnormal thickness growth of the cambium are discussed. 36 ref.

SPENT LIQUORS AND BY-PRODUCTS

ANON. Phenol from lignin. Chem. Week 88, no. 19: 77, 79, 81 (May 13, 1961).

In a lignin-hydrogenation process for the low-cost prodn. of phenols from spent sulfite liquor (*I*), devd. by the Noguchi Inst. of Tokyo and licensed by Crown Zellerbach Corp., LS (6% of *I*) is pptd. by addn. of lime (to pH 10.5) and a catalyst and heating to *ca.* 300°F. The ppt. (contg. 3% ash) is mixed with a heavy petroleum oil (initial b.p. *ca* 500°) and ball milled into a pumpable paste to which 0.5% of a cheap special catalyst (possibly chromium and/or cobalt cpds.) is added. The mix is fed through a heat exchanger to a hydrocracking reactor where it is trd. under rel. mild conditions to strip methoxyl groups and other side chains from the phenylpropane skeleton of lignin without breaking the aromatic rings. Trmt. for 30–60 min. at 700° and a hydrogen pressure of 3400 p.s.i. converts pract. all of the lignin into a mixt. of 25% *p*-cresol, 6% 4-ethylphenol, 5% 4-propylphenol, 12% dihydroxybenzenes, 11% aliphatic alcs., 22.5% recovered heavy petroleum oil, and 18.5% misc. solids. Under Jap. economic conditions, a plant for trg. 22,000 t. of lignin/yr. would cost *ca.* $2,800,000 and yield a return on investment of 24% before taxes. Evaln. of the process under U.S. mfg. conditions must await the outcome of large-scale ind. operation and market devt. for the phenolic prods.

GROTH, B., and REINHALL, R. White-water problems in the manufacture of wallboard by the wet method. Norsk Skogind. 15, no. 3: 112–16 (March, 1961). [Swed.; Engl. sum.]

The amts., cpn., and characs. of effluents from wet-process fiberboard mills are revd., and various possibilities of sepg. impurities from rel. concd. effluents are discussed. Although ordinary recirculation of white water may lead to difficulties, these can be avoided by washing the pulp according to a new method proposed by Defibrator AB. (Stockholm). The solubles are squeezed out directly after defibration in a double conical disk press, fresh water is added to the system only as shower water on the wet forming machine, and white water is discharged only from the disk press. The press discharge might be utilized for the prodn. of ethanol, fodder yeast, furfural, and other by-prods. 5 ref.

PULPWOOD AND CHIP STORAGE

PROSKURNIKOV, S. M. Winter storage of pulpwood in water. Bumazh. Prom. 35, no. 11: 22–3 (Nov., 1960). [Russ.]

A winter underwater storage system for pulpwood, used in the northern regions of the U.S.S.R., is described. Ice-free waterways or canals can be maintained in any nonstreaming body of water (lakes, watersheds, etc.) having a depth of at least 4 m. and an av. temp. of 0.35–0.4°C., by means of aeration and/or creating vert. currents in the water. The first means is used to prevent the freezing of the 200 m. wide canals, the second also serves for the transportation of logs, which are drawn by the currents into the canals from under the ice.

RHYNE, J. B., and BRINKLEY, A. W., JR. Seven months outside storage of pine and hardwood chips at the Panama City mill of International Paper Company. Southern Pulp Paper Mfr. 24, no. 2: 86, 88, 116–17 (Feb., 1961).

After 7 months of outside storage, pine and hardwood chips at the Panama City, Fla. mill showed various types of mold fungi throughout the piles, which could have been a major reason for the observed decreases in sp. gr. of the wood, in mech. strength props. and brightness of mfd. kraft pulps and liner-boards, and in the yields of black liquor skimmings (tall oil soap) and sulfate turpentine, compared with mill-run chips from a mixt. of green and aged roundwood. However, the results were comparable to those obtained on outside stored logs, except for much greater losses in soap and turpentine yields in the case of chips. Hence where these by-prods. are important for a mill's economy, outside chip storage should be regarded with caution.

SAWMILL RESIDUE FOR PULP

FOGH, I. F. An evaluation of the economics of supplying sawmill chips to pulp and paper mills. Pulp Paper Mag. Can. 62, no. 2: 95–101 (Feb., 1961).

The sale of sawmill residue in the form of slabs or chips to pulp and paper mills can add considerably to the income of a sawmill. Recent years have seen rapid devts. in machinery and equipment for barking and chipping of sawmill residue—slabs, edgings, and trimmings. Today it is possible to equip a medium-sized sawmill with a complete chip-prodn. plant for $40,000, and a small sawmill with an adequate barking setup for $7000. An anal. of the cost of prodg. chips for sawmills of various size is presented. 30 ref.

MALCOLM, F. B., REINEKE, L. H., and HALLOCK, H. Saw performance and lumber characteristics when producing pulpable southern pine sawdust. Madison, Wis., U.S. Forest Prods. Lab. [Rept. no. 2210] Feb., 1961. 50 p.

Factors involved in the sawing of lumber with a sparsed-tooth saw recently devd. for prodg, coarse sawdust chips suitable for pulping were studied. In an exploratory test of 3 inserted-tooth saws (48 in. diam.), there was no appreciable difference in performances between a 12-tooth and a 36-tooth saw at the same bite (feed rate) and at speeds below 600 r.p.m. Sawing-thickness variation was greater than acceptable at bites greater than 1/4 in. and cutting depths of 7 in. or more. Saw performance was poor at bites greater than 5/16 in. At the 1/4-in. bite necessary to produce 1/4-in. chips (said to be the smallest acceptable to the pulp and paper ind.), from 5/32 to 8/32 in. of added thickness was required to surface lumber acceptably, as compared with the std. surfacing allowance of 4/32 in. The greater thickness of the 18-tooth saw would require a tooth 3/8 in. wide to provide adequate side clearance for satisfactory operation; hence this saw was dropped from further study. Specific controlled performance tests and evalns. of the 12- and 36-tooth saws indicated that a bite of 1/4 in. can be maintained in southern pine logs without serious operational troubles, but that a considerable proportion of logs cannot be safely sawed at a 1/3-in. bite. At feeds up to 1/4 in., the 12-tooth saw was slightly more accurate. Max. thickness variation at bites of 1/4 and 1/3 inch was *ca.* 2 and 4–5 times as great as at a 1/8 in. bite, resp. Board thickness increased with the feed rate and gave progressively less kerf and more shavings. Bottom-edge tearout also increased with feed rate. Thickness allowance for surfacing both sides of a board increased with increased bite and ranged from 6/64 in. at 1/8 in. bite to obtain 75% compliance with grading rules and a 75% skip-free surface to 36/64 in. for 100% compliance and 100% skip-free surface at 1/3 in. bite. Economic considerations based on recent price situations indicated that improved sawing accuracy promises a greater gross prod. value than does the prodn. of kerf chips, since the resulting degradation of lumber surface is greater than the value of kerf chips.

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Forest Products Journal Index

Volume XI 1961

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The **Author Index** contains an entry for every author. For articles with a single author, the list gives author's name, subject, issue number, and page. For articles with two or more authors, the listing for the first author gives all names, subject, issue number, and page; listings for co-authors refer back to the first author.

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FPRS Title and Subject Index...Vol. XI, 1961

A

Accelerated Test for Measuring Lateral Dimensional Change of Wood-Based Panels, Saums, W. A., and Turner, H. D., 9: 406.

Accelerated Weathering of Red Oak Treated With Various Preservatives Used to Treat Crossties, Rietz, R. C., 12: 567.

Acetylation of Wood in Lumber Thickness, Goldstein, I. S., Jeroski, E. B., Lund, A. E., Nielson, J. F., and Weaver, J. W., 8: 363.

Acrylic Emulsion Paints for Exterior Wood Surfaces, Allyn, G., 1: 1.

Adhesives: See Glues & Gluing Processes.

Air Seasoning: See Drying.

Alerce

Natural Decay Resistance of Alerce, Clark, J. W., 3: 127.

Ammonium-Copper Pentachlorophenolate

New Water-Borne Preservative: Ammonium-Copper Pentachlorophenolate, Takamoto, H., 5: 229.

Anatomical Fettures of Permeable and Refractory Douglas-fir, Krahmer, R. L., 9: 439.

ANATOMY AND FUNDAMENTAL PROPERTIES

Better Understanding of Wood Through Basic Research, Bethel, J. S., 5: 238.

Biological Properties

Effect of Heat on the Decay Resistance of Wood, Scheffer, T. C., and Eslyn, W. E., 10: 485.

Natural Decay Resistance of Alerce, Clark, J. W., 3: 127.

Natural Decay Resistance of Guijo, Scheffer, T. C., and Eslyn, W. E., 6: 282.

Chemical Properties

Comparison of Three Methods for Determining the pH of Wood and Paper, Stamm, A. J., 7: 310.

Control of Brown Stain in Eastern White Pine, Stutz, R. E., Koch, P., and Oldham, M. L., 6: 258.

Physical Properties

Characteristics of Annual Rings in Relation to Wood Quality for White Spruce, Keith, C. T., 3: 122.

Characteristics of Compression Wood in Some Native Conifers, Core, H. A., Côté, W. A., Jr., and Day, A. C., 8: 356.

Comparison Between Measured and Theoretical Drying Diffusion Coefficients for Southern Pine, Stamm, A. J., and Nelson, R. M., Jr., 11: 536.

Effect of Temperature and Moisture Content on: Internal Friction and Speed of Sound in Douglas-fir, James, W. L., 9: 383.

Influence of Position in Tree on Recoverable Collapse in Wood, Pankevicius, E., 3: 131.
Progress and Problems of Genetic Improvement of Wood Quality, Duffield, J. W., 5: 211.
Quantitative Evaluation of Second Order Drying Stresses, Schniewind, A. P., and Kersavage, P. C., 11: 523.
Recent Progress Toward An Understanding of the Physical and Mechanical Properties of Wood, Youngs, R. L., 5: 214.
Relationship Between Gamma Ray Absorption and Wood Moisture Content and Density, Loos, W. E., 3: 145.
Variation of Wood Properties in Southern Red Oak, Hamilton, J. R., 6: 267.
Weight as a Measure of Volume for Southern Yellow Pine Lumber, Page, R. H., 7: 300.

Wood Structure

Anatomical Features of Permeable and Refractory Douglas-fir, Krahmer, R. L., 9: 439.
Architecture of Cellulose: A Microscopic Review, Rollins, M. L., and Tripp, V. W., 11: 493.
Crystallinity of Wood Cellulose Fibers Studied by X-Ray Methods, Lee, C. L., 2: 108.
Determining the Distribution of Interstructural Openings in Wood, Stamm, A. J., and Wagner, E., 3: 141.
Distribution of Hot-Water Soluble Material in Cell Walls and Cavities of Redwood, Tarkow, H., and Krueger, J., 5: 228.
Permeability of Douglas-Fir in Oregon, Miller, D. J., 1: 14.

Annual Rings

Characteristics of Annual Rings in Relation to Wood Quality for White Spruce, Keith, C. T., 3: 122.

Application of Hardboards in Construction, Rendall, R. R., 6: 248.
Applications of the Gamma-Ray Backscatter Technique to the Inspection of Utility Poles, Loos, W. E., 8: 333.
Applying Cumulative Frequency Distribution in Moisture Control During Kiln Drying, McMahon, E., 3: 133.
Architecture of Cellulose: A Microscopic Review, Rollins, M. L., and Tripp, V. W., 11: 493.

Aspen

Utilization of Aspen Wood Residues, Stranks, D. W., 7: 288.
Automate Your Lumber Sorting, DeKoning, E. W., 4: 178.

Automation: See Production Management.

B

Bark

Bonding Particle Boards with Bark Extracts, Anderson, A. B., Breuer, R. J., and Nicholls, G. A., 5: 226.
Holocellulose Determinations of Mountain Hemlock Bark, Wilson, J. D., 6: 260.
Separating Bark From Wood Chips, Blackford, J. M., 11: 515.

Bark Utilization

Sawdust, Bark and Other Wood Wastes for Soil Conditioning and Mulching, Bollen, W. B., and Glennie, D. W., 1: 38.
Better Understanding of Wood Through Basic Research, Bethel, J. S., 5: 238.
Biological Significance of ODPN-Insoluble and Glycol-Insoluble Tests, Reynolds, G., and Burch, J. E., 4: 201.

Bisphenols

Evaluation of Two Bisphenols as Wood-Preservative Agents, Fuller, R. G., 4: 193.
Bonding Particle Boards with Bark Extracts, Anderson, A. B., Breuer, R. J., and Nicholls, G. A., 5: 226.

Bound Copper

Preservative Action of Bound Copper and Zinc, Goldstein, I. S., Dreher, W. A., and Jeroski, E. B., 3: 128.

Brown Stain

Control of Brown Stain in Eastern White Pine, Stutz, R. E., Koch, P., and Oldham, M. L., 6: 258.
Brush, Dip, and Soak Treatments With Water-Repellent Preservatives, Verrall, A. F., 1: 23.
Building Homes to Withstand Hurricane Damage, Smith, W. R., 4: 176.
Business Education and the Forest Industries, Taylor, N. D., 6: 264.

C

Casein: See Glues and Gluing Processes.

Cellulose

Architecture of Cellulose: A Microscopic Review, Rollins, M. L., and Tripp, V. W., 11: 493.
Crystallinity of Wood Cellulose Fibers Studied by X-Ray Methods, Lee, C. L., 2: 108.

Charcoal: See also Chemical Conversion.
Method of Charcoal Analysis, Moore, W. E., and Beglinger, E., 1: 17.
Physico-Chemical Study: Wood Charcoal From a Cinder Block Kiln, Whitehead, T. H., and Sherrill, R. W., 8: 336.
Characteristics of Annual Rings in Relation to Wood Quality for White Spruce, Keith, C. T., 3: 122.
Characteristics of Compression Wood in Some Native Conifers, Core, H. A., Côté, W. A., Jr., and Day, A. C., 8: 356.

CHEMICAL CONVERSION

Review of Progress in Chemical Conversion, Rowe, J. W., and Pearl, I. A., 2: 85.

Derived Products

Economics of the Production of Furfural from Xylose Solutions, Harris, J. F., and Smuk, J. M., 7: 303.
FAO Technical Panel on Wood Chemistry: Working Party on Wood Hydrolysis, Locke, E. G., and Garnum, E., 8: 380.
Gas Chromatography for Tall Oil and Turpentine Analysis, Stine, I. A., and Doughty, J. B., 11: 530.
Magnefite Pulping of Douglas-Fir, Samuels, R., 3: 119.

Hydrolysis of Wood

FAO Technical Panel on Wood Chemistry: Working Party on Wood Hydrolysis, Locke, E. G., and Garnum, E., 8: 380.

Modification

Acetylation of Wood in Lumber Thickness, Goldstein, I. S., Jeroski, E. B., Lund, A. E., Nielson, J. F., and Weaver, J. W., 8: 363.
Bonding Particle Boards with Bark Extracts, Anderson, A. B., Breuer, R. J., and Nicholls, G. A., 5: 226.
Effectiveness of Stabilized Surface Layers of Wood as Moisture Barriers, Tarkow, H., and Ishaq, S. M., 4: 203.
Method of Charcoal Analysis, Moore, W. E., and Beglinger, E., 1: 17.
Physico-Chemical Study: Wood Charcoal from a Cinder Block Kiln, Whitehead, T. H., and Sherrill, R. W., 8: 336.
Sawdust, Bark and Other Wood Wastes for Soil Conditioning and Mulching, Bollen, W. B., and Glennie, D. W., 1: 38.

Pulping

Deterioration of Southern Pine Chips in Summer and Winter Storage, Saucier, J. R., and Miller, R. L., 8: 371.
Holocellulose Determinations of Mountain Hemlock Bark, Wilson, J. D., 6: 260.
Pertinent Developments in Continuous Pulping Systems, McCutcheon, J. O., 4: 185.
Studies on Lignin and Related Products. XV. Lignosulfonates of Birch Spent Sulfite Liquor, Pearl, I. A., and Beyer, D. L., 9: 442.
Utilization of Aspen Wood Residues, Stranks, D. W., 7: 288.

Chip Storage

Deterioration of Southern Pine Chips in Summer and Winter Storage, Saucier, J. R., and Miller, R. L., 8: 371.

Chromatography

Gas Chromatography for Tall Oil and Turpentine Analysis, Stine, I. A., and Doughty, J. B., 11: 530.

Collapse

Effect of Thermal Degradation on Shrinkage and Collapse of Wood from 3 Australian Species, Kauman, W. G., 9: 445.
Influence of Position in Tree on Recoverable Collapse in Wood, Pankevicius, E., 3: 131.
Value of Presteaming—For Drying Some Collapse-Susceptible Eucalypts, Campbell, G. S., 8: 341.
Commercial Hardwood Veneer Drying—Variables and Laboratory Correlation, Hale, T. F., 9: 420.
Commercialization of Research Results, Williston, E. M., 4: 190.
Comparison Between Measured and Theoretical Drying Diffusion Coefficients for Southern Pine, Stamm, A. J., and Nelson, R. M., Jr., 11: 536.
Comparison of Hot Press Interior Plywood Adhesives, Cass, S. B., Jr., 7: 285.
Comparison of Three Methods for Determining the pH of Wood and Paper, Stamm, A. J., 7: 310.

Compression Wood: See also Anatomy and Fundamental Properties.
Characteristics of Compression Wood in Some Native Conifers, Core, H. A., Côté, W. A., Jr., and Day, A. C., 8: 356.

Construction: See Wood Engineering.
Control of Brown Stain in Eastern White Pine, Stutz, R. E., Koch, P., and Oldham, M. L., 6: 258.
Corporate Image of Furniture Manufacturing, Freeman, S. W., 8: 340.
Costs—A Key to Sawmill Profits, Keppler, W. E., and Huxster, W. T., Jr., 9: 435.

Creosote: See also Treatments and Coatings.
New Method for Characterizing Mixtures of Creosote and Petroleum Oils, Burch, J. E., and Colley, R. H., 4: 197.

Creosote Extraction
Hot- and Cold-Solvent Techniques for Creosote Extraction, Smeal, T. W., Wolfson, M. L., and Leach, C. W., 9: 409.

Crossties
Accelerated Weathering of Red Oak Treated With Various Preservatives Used to Treat Crossties, Rietz, R. C., 12: 567.
Oregon Woods for Crossties, Miller, D. J., 12: 579.
Crystallinity of Wood Cellulose Fibers Studied by X-Ray Methods, Lee, C. L., 2: 108.

D

Decay Detection
Applications of the Gamma-Ray Backscatter Technique to the Inspection of Utility Poles, Loos, W. E., 8: 333.

Decay Resistance
Effect of Heat on the Decay Resistance of Wood, Scheffer, T. C., and Eslyn, W. E., 10: 485.
Natural Decay Resistance of Alerce, Clark, J. W., 3: 127.
Natural Decay Resistance of Guijo, Scheffer, T. C., and Eslyn, W. E., 6: 282.

Density Measurements
Applications of the Gamma-Ray Backscatter Technique to the Inspection of Utility Poles, Loos, W. E., 8: 333.
Relationship Between Gamma Ray Absorption and Wood Moisture Content and Density, Loos, W. E., 3: 145.
Deterioration of Southern Pine Chips in Summer and Winter Storage, Saucier, J. R., and Miller, R. L., 8: 371.
Determining the Distribution of Interstructural Openings in Wood, Stamm, A. J., and Wagner, E., 3: 141.

Diffusion Coefficients: See Drying.

Dimensional Stability of Oak Flake Board As Affected by Particle Geometry and Resin Spread, Jorgensen, R. N., and Odell, R. L., 10: 463.

Dimensional Stabilization
Accelerated Test for Measuring Lateral Dimensional Change of Wood-Based Panels, Saums, W. A., and Turner, H. D., 9: 406.
Acetylation of Wood in Lumber Thickness, Goldstein, I. S., Jeroski, E. B., Lund, A. E., Nielson, J. F., and Weaver, J. W., 8: 363.
Effectiveness of Stabilized Surface Layers of Wood as Moisture Barriers, Tarkow, H., and Ishag, S. M., 4: 203.
Seasoning Green-Wood Carvings With Polyethylene Glycol-1000, Mitchell, H. L., and Iverson, E. S., 1: 7.
Distortions of Wood: Drying With and Without Restraint, Stevens, W. C., 8: 348.
Distribution of Extractives in Solvent Seasoned Redwood Lumber, Anderson, A. B., and Fearing, W. B., 5: 240.
Distribution of Hot-Water Soluble Material in Cell Walls and Cavities of Redwood, Tarkow, H., and Krueger, J., 5: 228.

Douglas-Fir
Anatomical Features of Permeable and Refractory Douglas-fir, Krahmer, R. L., 9: 439.
Effect of Temperature and Moisture Content on: Internal Friction and Speed of Sound in Douglas-fir, James, W. L., 9: 383.
Magnefite Pulping of Douglas-Fir, Samuels, R., 3: 119.
Permeability of Douglas-Fir in Oregon, Miller, D. J., 1: 14.

DRYING
Progress in Wood Drying—1960, Ellwood, E. L., 2: 55.

Kiln Drying
Applying Cumulative Frequency Distribution in Moisture Control During Kiln Drying, McMahon, E., 3: 133.
Distortions of Wood: Drying With and Without Restraint, Stevens, W. C., 8: 348.
Distribution of Extractives in Solvent Seasoned Redwood Lumber, Anderson, A. B., and Fearing, W. B., 5: 240.
Effect of Thermal Degradation on Shrinkage and Collapse of Wood from 3 Australian Species, Kauman, W. G., 9: 445.
Forced-Air Drying of Lumber—Research and Experimental, Rucker, T. W., and Smith, W. R., 9: 390.
High Temperature Drying: Research, Application, and Experience in Germany, Kollmann, F. F. P., 11: 508.
Influence of Position in Tree on Recoverable Collapse in Wood, Pankevicius, E., 3: 131.
Value of Presteaming—For Drying Some Collapse-Susceptible Eucalypts, Campbell, G. S., 8: 341.

Moisture-Use Relationship
Determining the Distribution of Interstructural Openings in Wood, Stamm, A. J., and Wagner, E., 3: 141.
Distribution of Hot-Water Soluble Material in Cell Walls and Cavities of Redwood, Tarkow, H., and Krueger, J., 5: 228.
Quantitative Evaluation of Second Order Drying Stresses, Schniewind, A. P., and Kersavage, P. C., 11: 523.
Comparison Between Measured and Theoretical Drying Diffusion Coefficients for Southern Pine, Stamm, A. J., and Nelson, R. M., Jr., 11: 536.
Effect of Temperature and Moisture Content on: Internal Friction and Speed of Sound in Douglas-fir, James, W. L., 9: 383.
Quantitative Evaluation of Second Order Drying Stresses, Schniewind, A. P., and Kersavage, P. C., 11: 523.
Relationship Between Gamma Ray Absorption and Wood Moisture Content and Density, Loos, W. E., 3: 145.

Special Products
Seasoning Green-Wood Carvings With Polyethylene Glycol-1000, Mitchell, H. L., and Iverson, E. S., 1: 7.

Veneer Drying
Commercial Hardwood Veneer Drying—Variables and Laboratory Correlation, Hale, T. F., 9: 420.
Drying Stresses in Veneer and Their Relief, Kuebler, H., 7: 324.
Evaluation of an Oil-Fired Veneer Dryer—Its Effect on Glue Bond Quality, Sisterhenn, G. H., 5: 207.
Varying Moisture Content of Mechanically Dried Veneers, Carruthers, J. F. S., and Hudson, R. W., 7: 293.
Drying Stresses in Veneer and Their Relief, Kuebler, H., 7: 324.

E

Eastern White Pine
Control of Brown Stain in Eastern White Pine, Stutz, R. E., Koch, P., and Oldham, M. L., 6: 258.
Economics of Automatic Lumber Sorting, Clapham, J. C., and Lambe, T. A., 7: 320.
Economics of Machine Replacement, Johnson, E. S., and Shook, E. A., 10: 467.
Economics of the Production of Furfural from Xylose Solutions, Harris, J. F., and Smuk, J. M., 7: 303.

Education: See Industry-Education.

Effect of Heat on the Decay Resistance of Wood, Scheffer, T. C., and Eslyn, W. E., 10: 485.
Effect of Particle Geometry and Resin Spread on Glue-Line Thickness and Distribution, Jorgensen, R. N., and Murphey, W. K., 12: 582.
Effect of Temperature and Moisture Content on: Internal Friction and Speed of Sound in Douglas-fir, James, W. L., 9: 383.
Effect of Thermal Degradation on Shrinkage and Collapse of Wood from 3 Australian Species, Kauman, W. G., 9: 445.
Effectiveness of Stabilized Surface Layers of Wood as Moisture Barriers, Tarkow, H., and Ishaq, S. M., 4: 203.

Emulsion Paints: See also Treatments and Coatings.
Acrylic Emulsion Paints for Exterior Wood Surfaces, Allyn, G., 1: 1.
End-Use Approach to Particle Board Standard, Hamilton, J. F., 5: 234.

ENGINEERING: See Wood Engineering.

Eucalypts
Value of Presteaming—For Drying Some Collapse-Susceptible Eucalypts, Campbell, G. S., 8: 341.
Evaluation of an Oil-Fired Veneer Dryer—Its Effect on Glue Bond Quality, Sisterhenm, G. H., 5: 207.
Evaluation of Two Bisphenols as Wood-Preservative Agents, Fuller, R. G., 4: 193.

Extractives
Distribution of Extractives in Solvent Seasoned Redwood Lumber, Anderson, A. B., and Fearing, W. B., 5: 240.

F

Factors Affecting Sawmill Output, Bruce, R. W., 10: 471.
FAO Technical Panel on Wood Chemistry: Working Party on Wood Hydrolysis, Locke, E. G., and Garnum, E., 8: 380.
Fire Retardants: See Treatments and Coatings.
First-Hand Report on the Latin American Forestry Institute, Jorgensen, R. N., 7: 330.
Flakeboard: See Particle and Fiber Processes.
Forced-Air Drying of Lumber—Research and Experimental, Rucker, T. W., and Smith, W. R., 9: 390.

Furfural
Economics of the Production of Furfural from Xylose Solutions, Harris, J. F., and Smuk, J. M., 7: 303.
Fumigants Kill the Oak Wilt Fungus in Wood, Partridge, A. D., 1: 12.

G

Gamma Rays
Applications of the Gamma-Ray Backscatter Technique to the Inspection of Utility Poles, Loos, W. E., 8: 333.
Relationship Between Gamma Ray Absorption and Wood Moisture Content and Density, Loos, W. E., 3: 145.

Gas Chromatography for Tall Oil and Turpentine Analysis, Stine, I. A., and Doughty, J. B., 11: 530.

Genetics
Progress and Problems of Genetic Improvement of Wood Quality, Duffield, J. W., 5: 211.

GLUES AND GLUING PROCESSES

Progress in 1960—Glues and Gluing Processes, Blomquist, R. F., 2: 77.
Effect of Particle Geometry and Resin Spread on Glue-Line Thickness and Distribution, Jorgensen, R. N., and Murphey, W. K., 12: 582.

Adhesives
Bonding Particle Boards with Bark Extracts, Anderson, A. B., Breuer, R. J., and Nicholls, G. A., 5: 226.
Some Factors Affecting Resin Efficiency in Flake Board, Burrows, C. H., 1: 27.

End- and Edge-Gluing
Paper Overlaid Lumber, Heebink, B. G., 4: 167.
Resistance of Casein Glue Joints to Shear Fatigue Stressing, Moslemi, A. A., 3: 115.

Plywood and Glue Lam
Comparison of Hot-Press Interior Plywood Adhesives, Cass, S. B., Jr., 7: 285.
Evaluation of an Oil-Fired Veneer Dryer—Its Effect on Glue Bond Quality, Sisterhenm, G. H., 5: 207.
Gluing Characteristics of Softwood Veneers and Secondary Western Hardwood, Carstensen, J. P., 7: 313.
Microscopic Identification of Undercured Glue Bonds in Plywood, Hancock, W. V., and Northcott, P. N., 7: 316
Plywood in the Sixties, Peterson, M. K., 6: 245.
Pre-Pressing Plywood Assemblies, Lambuth, A. L., 9: 416.

Gluing Characteristics of Softwood Veneers and Secondary Western Hardwood, Carstensen, J. P., 7: 313.

Guijo
Natural Decay Resistance of Guijo, Scheffer, T. C., and Eslyn, W. E., 6: 282.

H

Hardboard—State of the Industry and Its Use Practice, Walling, W. C., 11: 519.

Hardboard: See Particle and Fiber Processes.

Hemlock
Holocellulose Determinations of Mountain Hemlock Bark, Wilson, J. D., 6: 260.

High Temperature Drying: Research, Application, and Experience in Germany, Kollmann, F. F. P., 11: 508.

Holocellulose Determinations of Mountain Hemlock Bark, Wilson, J. D., 6: 260.

Hot- and Cold-Solvent Techniques for Creosote Extraction, Smeal, T. W., Wolfson, M. L., and Leach, C. W., 9: 409.

Hot-Pressing
Comparison of Hot-Press Interior Plywood Adhesives, Cass, S. B., Jr., 7: 285.

Hydrolysis of Wood: See Chemical Conversion.

I

Industry-Education
Business Education and the Forest Industries, Taylor, N. D., 6: 264.
First-Hand Report on The Latin American Forestry Institute, Jorgensen, R. N., 7: 330.
People, Trees and Direction, Johnson, C. M., 3: 139.
Research Challenges Corporate Management, Rankin, J. W., 5: 232.

Inelastic Behavior of Wood: A New Concept for Improved Panel Forming Processes, Kunesh, R. H., 9: 395.

Influence of Position in Tree on Recoverable Collapse in Wood, Pankevicius, E., 3: 131.

Interrelation of Government and Private Research, Heritage, C. C., 12: 586.

Interior Plywood
Comparison of Hot-Press Interior Plywood Adhesives, Cass, S. B., Jr., 7: 285.

K

Kiln Drying: See Drying.

L

Let's Integrate Our Markets Too!, Aram, J. L., 4: 205.

Lignin: See also Chemical Conversion.
Studies on Lignin and Related Products. XV. Lignosulfonates of Birch Spent Sulfite Liquor, Pearl, I. A., and Beyer, D. L., 9: 442.

Linear Programming
Linear Programming in Log Production, Smith, G. W., and Harrell, C., 1: 8.
Linear Programming in Lumber Production, Jackson, N. D., and Smith, G. W., 6: 272.

Logging: See also Timber Production.
Progress in Logging—1960, Doyle, J. A., 2: 49.

Lumber Industry: New Leadership, Jenkins, E. H., 7: 297.

Lumber and Lumber Manufacturing: See also Mechanical Conversion.
Paper Overlaid Lumber, Heebink, B. G., 4: 167.
Lumber Manufacturing—1960, Barrow, J. L., Jr., 2: 53.

Lumber Sorting: See also Production Management.
Automate Your Lumber Sorting, De-Koning, E. W., 4: 178.
Economics of Automatic Lumber Sorting, Clapham, J. C., and Lambe, T. A., 7: 320.
Operations-Research Approach to Lumber Sorting, Clapham, J. C., and Lambe, T. A., 4: 181.

M

Magnefite Pulping of Douglas-fir, Samuels, R., 3: 119.

MARKETING

Commercialization of Research Results, Williston, E. M., 4: 190.
Let's Integrate Our Markets Too!, Aram, J. L., 4: 205.
Marketing of Lumber and Forest Products to the Government, Camarano, A. M., 9: 428.
Wooden Pallets and Pallet Containers: Present and Future Markets, Sardo, W. H., Jr., 12: 576.

Distribution
New Houses: Hoy Many are Built with Wood?, Herrick, D. E., and Phelps, R. B., 11: 544.

Product Standards
End-Use Approach to Particle Board Standards, Hamilton, J. F., 5: 234.
Product Development—Keystone to Expanded Markets, Dosker, C. D., 9: 423.

Promotion
Lumber Industry: New Leadership, Jenkins, E. H., 7: 297.
Hardboard—State of the Industry and Its Use Practice, Walling, W. C., 11: 519.
Particleboard—Today and Tomorrow, Dougherty, R. B., 9: 433.
Plywood in the Sixties, Peterson, M. K., 6: 245.
Revitalization Through Modern Marketing, Hood, A. B., 9: 426.

Marketing of Lumber and Forest Products to the Government, Camarano, A. M., 9: 428.

Measuring the Effectiveness of Water-Repellent Preservatives, Miniutti, V. P., Mraz, E. A., and Black, J. M., 10: 453.

MECHANICAL CONVERSION

Lumber Manufacturing—1960, Barrow, J. L., Jr., 2: 53.

Sawing
Costs—A Key to Sawmill Profits, Keppler, W. E., and Huxster, W. T., Jr., 9: 435.
Factors Affecting Sawmill Output, Bruce, R. W., 10: 471.
Linear Programming in Lumber Production, Jackson, N. D., and Smith, G. W., 6: 272.

Modified Wood
Acetylation of Wood in Lumber Thickness, Goldstein, I. S., Jeroski, E. B., Lund, A. E., Nielson, J. F., and Weaver, J. W., 8: 363.
Effectiveness of Stabilized Surface Layers of Wood as Moisture Barriers, Tarkow, H., and Ishaq, S. M., 4: 203.

Method of Charcoal Analysis, Moore, W. E., and Beglinger, E., 1: 17.

Microscopic Identification of Undercured Glue Bonds in Plywood, Hancock, W. V., and Northcott, P. N., 7: 316.

Moisture Control
Applying Cumulative Frequency Distribution in Moisture Control During Kiln Drying, McMahon, E., 3: 133.

Moisture Measurements: See also Drying and Anatomy and Fundamental Properties.

Moisture-Use Relationship: See Drying.

N

Natural Decay Resistance of Alerce, Clark, J. W., 3: 127.

Natural Decay Resistance of Guijo, Scheffer, T. C., and Eslyn, W. E., 6: 282.

New Houses: How Many are Built With Wood?, Herrick, D. E., and Phelps, R. B., 11: 544.

New Method for Characterizing Mixtures of Creosote and Petroleum Oils, Burch, J. E., and Colley, R. H., 4: 197.

New Water-Borne Preservative: Ammonium-Copper Pentachlorophenolate, Takamoto, H., 5: 229.

New Wood Preserving Process, Goodwin, D. R., and Hug, R. E., 11: 504.

Nondestructive Test for Stiffness of Structural Lumber, Hoyle, R. J., 6: 251.

Nondestructive Testing
Effect of Temperature and Moisture Content on: Internal Friction and Speed of Sound in Douglas-fir, James, W. L., 9: 383.
Nondestructive Test for Stiffness of Structural Lumber, Hoyle, R. J., 6: 251.

Non-Hygroscopic Fire Retardant Treatment for Wood, Goldstein, I. S., and Dreher, W. A., 5: 235.

O

Oak Wilt
Fumigants Kill The Oak Wilt Fungus In Wood, Partridge, A. D., 1: 12.
Operations-Research Approach to Lumber Sorting, Clapham, J. C., and Lambe, T. A., 4: 181.
Oregon Woods for Crossties, Miller, D. J., 12: 579.
Oscillating Pressure Treatment of 10 U. S. Woods, Blew, J. O., Jr., Henriksson, S. T., and Hudson, M. S., 6: 275.

P

Paints and Painting: See also Treatments and Coatings.
Acrylic Emulsion Paints for Exterior Wood Surfaces, Allyn, G., 1: 1.
Performance of Some Blister -Resistant Paints, Crosby, J. N., 6: 255.
Paper Overlaid Lumber, Heebink, B. G., 4: 167.
Pallets
Wooden Pallets and Pallet Containers: Present and Future Markets, Sardo, W. H., Jr., 12: 576.
Paper Overlays
Paper Overlaid Lumber, Heebink, B. G., 4: 167.

PARTICLE AND FIBER PROCESSES
Architecture of Cellulose: A Microscopic Review, Rollins, M. L., and Tripp, V. W., 11: 493.
Crystallinity of Wood Cellulose Fibers Studied by X-Ray Methods, Lee, C. L., 2: 108.
Flakeboard
Dimensional Stability of Oak Flake Board As Affected by Particle Geometry and Resin Spread, Jorgensen, R. N., and Odell, R. L., 10: 463.
Relationship of Flake Size and Resin Content to Mechanical and Dimensional Properties of Flake Board, Post, P. W., 1: 34.
Some Factors Affecting Resin Efficiency in Flake Board, Burrows, C. H., 1: 27.
Hardboard
Application of Hardboards in Construction, R. R. Rendall, 6: 248.
Hardboard—State of the Industry and Its Use Practice, Walling, W. C., 11: 519.
Particleboard
Accelerated Test for Measuring Lateral Dimensional Change of Wood-Based Panels, Saums, W. A., and Turner, H. D., 9:406.
Bonding Particle Boards with Bark Extracts, Anderson, A. B., Breuer, R. J., and Nicholls, G. A., 5: 226.
End-Use Approach to Particle Board Standards, Hamilton, J. F., 5: 234.
Inelastic Behavior of Wood: A New Concept for Improved Panel Forming Processes, Kunesh, R. H., 9: 395.
Particleboard—Today and Tomorrow, Dougherty, R. B., 9: 433.
Simplified Data-Handling Techniques for Particle Board and Hardboard, Carroll, M., 3: 149.
Pulp and Paper Board
Comparison of Three Methods for Determining the pH of Wood and Paper, Stamm, A. J., 7: 310.
Deterioration of Southern Pine Chips in Summer and Winter Storage, Saucier, J. R., and Miller, R. L., 8: 371.
Separating Bark From Wood Chips, Blackford, J .H., 11: 515.
Particleboard: See Particle and Fiber Processes.
Particleboard—Today and Tomorrow, Dougherty, R. B., 9: 433.
People, Trees and Direction, Johnson, C. M., 3: 139.
Performance of Some Blister-Resistant Paints, Crosby, J. N., 6: 255.
Permeability of Douglas-Fir in Oregon, Miller, D. J., 1: 14.
Pertinent Developments in Continuous Pulping Systems, McCutcheon, J. O., 4: 185.
Petroleum Oils
New Method for Characterizing Mixtures of Creosote and Petroleum Oils, Burch, J. E., and Colley, R. H., 4: 197.
Physico-Chemical Study: Wood Charcoal From a Cinder Block Kiln, Whitehead, T. H., and Sherrill, R. W., 8: 336.
Plywood in the Sixties, Peterson, M. K., 6: 245.
Plywood: See also Glues and Gluing Processes.
Comparison of Hot-Press Interior Plywood Adhesives, Cass, S. B., Jr., 7: 285.
Polyester Finishes
Production with Polyester Finishes, Picton, J. W., 7: 283.
Polyethylene Glycol
Seasoning Green-Wood Carvings With Polyethylene Glycol-1000, Mitchell, H. L., and Iversen, E. S., 1: 7.
Pre-Pressing Plywood Assemblies, Lambuth, A. L., 9: 416.
Preservation: See Treatments and Coatings.
Preservative Action of Bound Copper and Zinc, Goldstein, I. S., Dreher, W. A., and Jeroski, E. B., 3: 128.
Pressure Treatment
Oscillating Pressure Treatment of 10 U. S. Woods, Blew, J. O., Jr., Henriksson, S. T., and Hudson, M. S., 6: 275.
Presteaming
Value of Presteaming—For Drying Some Collapse-Susceptible Eucalypts, Campbell, G. S., 8: 341.
Product Development—Keystone to Expanded Markets, Dosker, C. D., 9: 423.

PRODUCTION MANAGEMENT
Automation
Automate Your Lumber Sorting, DeKoning, E. W., 4: 178.
Materials Handling
Costs—A Key to Sawmill Profits, Keppler, W. E., and Huxster, W. T., Jr., 9: 435.
Economics of Automatic Lumber Sorting, Clapham, J. C., and Lambe, T. A., 7: 320.
Separating Bark From Wood Chips, Blackford, J. M., 11: 515.
Quality Control
Corporate Image of Furniture Manufacturing, Freeman, S. W., 8: 340.
Simplified Data-Handling Techniques for Particle Board and Hardboard, Carroll, M., 3: 149.
Production Control
Economics of Machine Replacement, Johnson, E. S., and Shook, E. A., 10: 467.
Factors Affecting Sawmill Output, Bruce, R. W., 10: 471.
Production with Polyester Finishes, Picton, J. W., 7: 283.
Work Measurements
Linear Programming in Log Production, Smith, G. W., and Harrell, C., 1: 8.
Linear Programming in Lumber Production, Jackson, N. D., and Smith, G. W., 6: 272.
Operations-Research Approach to Lumber Sorting, Clapham, J. C., and Lambe, T. A., 4: 181.
Production with Polyester Finishes, Picton, J. W., 7: 283.
Progress in Logging—1960, Doyle, J. A., 2: 49.
Progress in 1960—Glues and Gluing Processes, Blomquist, R. F., 2: 77.
Progress and Problems of Genetic Improvement of Wood Quality, Duffield, J. W., 5: 211.
Progress in Wood Drying—1960, Ellwood, E. L., 2: 55.
Progress in Wood Preservation, 1959–1960, Troxell, H. E., 2: 67.

Q

Quality Control: See Production Management.
Quantitative Evaluation of Second Order Drying Stresses, Schniewind, A. P., and Kersavage, P. C., 11: 523.

R

Recent Progress Toward an Understanding of the Physical and Mechanical Properties of Wood, Youngs, R. L., 5: 214.
Red Oak
Accelerated Weathering of Red Oak Treated With Various Preservatives Used to Treat Crossties, Rietz, R. C., 12: 567.
Variation of Wood Properties in Southern Red Oak, Hamilton, J. R., 6: 267.
Redwood
Distribution of Extractives in Solvent Seasoned Redwood Lumber, Anderson, A. B., and Fearing, W. B., 5: 240.
Distribution of Hot-Water Soluble Material in Cell Walls and Cavities of Redwood, Tarkow, H., and Krueger, J., 5: 228.
Relationship Between Gamma Ray Absorption and Wood Moisture Content and Density, Loos, W. E., 3: 145.
Relationship of Flake Size and Resin Content to Mechanical and Dimensional Properties of Flake Board, Post, P. W., 1: 34.
Research Challenges Corporate Management, Rankin, J. W., 5: 232.
Research: See also Industry-Education.
Better Understanding of Wood Through Basic Research, Bethel, J. S., 5: 238.
Brief Resumé of Forest Research in India, 5: 243.
Commercialization of Research Results, Williston, E. M., 4: 190.
First-Hand Report on The Latin American Forestry Institute, Jorgensen, R. N., 7: 330.
Interrelation of Government and Private Research, Heritage, C. C., 12: 586.
Special Report: The Industry's Research Programming for 1962, 12: 545.
Resistance of Casein Glue Joints to Shear Fatigue & Stressing, Moslemi, A. A., 3: 115.
Review of Progress in Chemical Conversion, Rowe, J. W., and Pearl, I. A., 2: 85.
Revitalization Through Modern Marketing, Hood, A. B., 9: 426.

S

Sawdust, Bark, and Other Wood Wastes for Soil Conditioning and Mulching, Bollen, W. B., and Glennie, D. W., 1: 38.
Seasoning Green-Wood Carvings With Polyethylene Glycol-1000, Mitchell, H. L., and Iverson, E. S., 1: 7.
Separating Bark From Wood Chips, Blackford, J. M., 11: 515.

Shear Stresses
Resistance of Casein Glue Joints to Shear Fatigue Stressing, Moslemi, A. A., 3: 115.
Simplified Data-Handling Techniques for Particle Board and Hardboard, Carroll, M., 3: 149.
Soil Conditioners
Sawdust, Bark and Other Wood Wastes for Soil Conditioning and Mulching, Bollen, W. B., and Glennie, D. W., 1: 38.
Solvent Seasoning
Distribution of Extractives in Solvent Seasoned Redwood Lumber, Anderson, A. B., and Fearing, W. B., 5: 240.
Some Factors Affecting Resin Efficiency in Flake Board, Burrows, C. H., 1: 27.
Southern Pine
Deterioration of Southern Pine Chips in Summer and Winter Storage, Saucier, J. R., and Miller, R. L., 8: 371.
Comparison Between Measured and Theoretical Drying Diffusion Coefficients for Southern Pine, Stamm, A. J., and Nelson, R. M., Jr., 11: 536.
Weight as a Measure of Volume for Southern Yellow Pine Lumber, Page, R. H., 7: 300.
Special Report: The Industry's Research Programming for 1962, 12: 545.
Strength: See Anatomy and Fundamental Properties, Drying, and Wood Engineering.
Stress Relief: See Drying.
Sulfite Liquor
Studies on Lignin and Related Products. XV. Lignosulfonates of Birch Spent Sulfite Liquor, Pearl, I. A., and Beyer, D. L., 9: 442.

T

Tall Oils
Gas Chromatography for Tall Oil and Turpentine Analysis, Stine, I. A., and Doughty, J. B., 11: 530.

TIMBER PRODUCTION
Forestry
Progress and Problems of Genetic Improvement of Wood Quality, Duffield, J. W., 5: 211.
Forest Economics
Linear Programming in Log Production, Smith, G. W., and Harrell, C., 1: 8.
People, Trees and Direction, Johnson, C. M., 3: 139.
Weight as a Measure of Volume for Southern Yellow Pine Lumber, Page, R. H., 7: 300.
Harvesting
Separating Bark From Wood Chips, Blackford, J. M., 11: 515.
Logging
Progress in Logging—1960, Doyle, J. A., 2: 49.
Time-Dependent Strain Behavior of Wood in Tension Parallel to the Grain, King, E. G., Jr., 3: 156.
Tolerance of Some Fungi to a Water-Soluble Preservative and Its Components, Madhosingh, C., 1: 20.

TREATMENTS AND COATINGS
Hot- and Cold-Solvent Techniques for Creosote Extraction, Smeal, T. W., Wolfson, M. L., and Leach, C. W., 9: 409.
Exterior Finishing
Acrylic Emulsion Paints for Exterior Wood Surfaces, Allyn, G., 1: 1.
Performance of Some Blister-Resistant Paints, Crosby, J. N., 6: 255.
Fire Retardants
Non-Hygroscopic Fire Retardant Treatment for Wood, Goldstein, I. S., and Dreher, W. A., 5: 235.
Interior Finishing
Production with Polyester Finishes, Picton, J. W., 7: 283.
Preservation
Accelerated Weathering of Red Oak Treated With Various Preservatives Used to Treat Crossties, Rietz, R. C., 12: 567.
Applications of the Gamma-Ray Backscatter Technique to the Inspection of Utility Poles, Loos, W. E., 8: 333.
Biological Significance of ODPN-Insoluble and Glycol-Insoluble Tests, Reynolds, G. and Burch, J. E., 4: 201.
Brush, Dip, and Soak Treatments With Water-Repellent Preservatives, Verrall, A. F., 1: 23.
Control of Brown Stain in Eastern White Pine, Stutz, R. E., Koch, P., and Oldham, M. L., 6: 258.
Evaluation of Two Bisphenols as Wood-Preservative Agents, Fuller, R. G., 4: 193.
Fumigants Kill The Oak Wilt Fungus In Wood, Partridge, A. D., 1: 12.
Measuring the Effectiveness of Water-Repellent Preservatives, Miniutti, V. P., Mraz, E. A., and Black, J. M., 10: 453.
New Method for Characterizing Mixtures of Creosote and Petroleum Oils, Burch, J. E., and Colley, R. H., 4: 197.
New Water-Borne Preservative: Ammonium-Copper Pentachlorophenolate, Takamoto, H., 5: 229.
New Wood Preserving Process, Goodwin, D. R., and Hug, R. E., 11: 504.
Oscillating Pressure Treatment of 10 U. S. Woods, Blew, J. O., Jr., Henriksson, S. T., and Hudson, M. S., 6: 275.
Permeability of Douglas-Fir in Oregon, Miller, D. J., 1: 14.
Preservative Action of Bound Copper and Zinc, Goldstein, I. S., Dreher, W. A., and Jeroski, E. B., 3: 128.
Progress in Wood Preservation, 1959–1960, Troxell, H. E., 2: 67.
Relationship Between Gamma Ray Absorption and Wood Moisture Content and Density, Loos, W. E., 3: 145.
Tolerance of Some Fungi to a Water-Soluble Preservative and Its Components, Madhosingh, C., 1: 20.
Turpentine
Gas Chromatography for Tall Oil and Turpentine Analysis, Stine, I. A., and Doughty, J. B., 11: 530.

U

Utility Poles
Applications of the Gamma-Ray Backscatter Technique to the Inspection of Utility Poles, Loos, W. E., 8: 333.
Utilization of Aspen Wood Residues, Stranks, D. W., 7: 288.

V

Value of Presteaming—For Drying Some Collapse-Susceptible Eucalypts, Campbell, G. S., 8: 341.
Varying Moisture Content of Mechanically Dried Veneers, Carruthers, J. F. S., and Hudson, R. W., 7: 293.
Variation of Wood Properties in Southern Red Oak, Hamilton, J. R., 6: 267.
Veneer: See Glues and Gluing Processes and Drying.

VENEERS AND PLYWOOD
Commercial Hardwood Veneer Drying —Variables and Laboratory Correlation, Hale, T. F., 9: 420.
Drying Stresses in Veneer and Their Relief, Kuebler, H., 7: 324.
Gluing Characteristics of Softwood Veneers and Secondary Western Hardwood, Carstensen, J. P., 7: 313.
Pre-Pressing Plywood Assemblies, Lambuth, A. L., 9: 416.

W

Waste Utilization
Sawdust, Bark and Other Wood Wastes for Soil Conditioning and Mulching, Bollen, W. B., and Glennie, D. W., 1: 38.
Separating Bark From Wood Chips, Blackford, J. M., 11: 515.
Utilization of Aspen Wood Residues, Stranks, D. W., 7: 288.
Water-Repellent Preservatives: See also Treatments and Coatings.
Brush, Dip, and Soak Treatments With Water-Repellent Preservatives, Verrall, A. F., 1: 23.
Weight as a Measure of Volume for Southern Yellow Pine Lumber, Page, R. H., 7: 300.
Western Hardwood
Gluing Characteristics of Softwood Veneers and Secondary Western Hardwood, Carstensen, J. P., 7: 313.
White Spruce
Characteristics of Annual Rings in Relation to Wood Quality for White Spruce, Keith, C. T., 3: 122.
Wood-Aluminum Beams Within and Beyond the Elastic Range. I. Rectangular Sections, Mark, R., 10: 477.

WOOD ENGINEERING
Construction
Building Homes to Withstand Hurricane Damage, Smith, W. R., 4: 176.
Engineered Products
Application of Hardboards in Construction, Rendall, R. R., 6: 248.
New Houses: How Many are Built with Wood?, Herrick, D. E., and Phelps, R. B., 11: 544.
Resistance of Casein Glue Joints to Shear Fatigue Stressing, Moslemi, A. A., 3: 115.
Wood-Aluminum Beams Within and Beyond the Elastic Range. I. Rectangular Sections, Mark, R., 10: 477.
Mechanical Properties
Inelastic Behavior of Wood: A New Concept for Improved Panel Forming Processes, Kunesh, R. H., 9: 395.
Nondestructive Test for Stiffness of Structural Lumber, Hoyle, R. J., 6: 251.
Time-Dependent Strain Behavior of Wood in Tension Parallel to the Grain, King, E. G., Jr., 3: 156.
Wooden Pallets and Pallet Containers: Present and Future Markets, Sardo, W. H., Jr., 12: 576.
Wood Quality
Characteristics of Annual Rings in Relation to Wood Quality for White Spruce, Keith, C. T., 3: 122.
Progress and Problems of Genetic Improvement of Wood Quality, Duffield, J. W., 5: 211.

X

Xylose
Economics of the Production of Furfural from Xylose Solutions, Harris, J. F., and Smuk, J. M., 7: 303.

Z

Zinc
Preservative Action of Bound Copper and Zinc, Goldstein, I. S., Dreher, W. A., and Jeroski, E. B., 3: 128.

FPRS Author Index . . . Volume XI, 1961

A

Allyn, G., Acrylic Emulsion Paints for Exterior Wood Surfaces, 1: 1. (No. 1636—$1.00)
Anderson, A. B., Breuer, R. J., and Nicholls, G. A., Bonding Particle Boards with Bark Extracts, 5: 226. (No. 1814—$.40)
Anderson, A. B., and Fearing, W. B., Distribution of Extractives in Solvent Seasoned Redwood Lumber, 5: 240. (No. 1724—$.60)
Aram, J. L., Let's Integrate Our Markets Too!, 4: 205. (No. 1743—$.40)

B

Barrow, J. L., Jr., Lumber Manufacturing 1960, 2: 53. (No. 1860—$.40)
Beglinger, E., *see* Moore, W. E.
Bethel, J. S., A Better Understanding of Wood Through Basic Research, 5: 238. (No. 1835—$.40)
Beyer, D. L., *see* Pearl, I. A.
Black, J. M., *see* Miniutti, V. P.
Blew, J. O., Jr., Henriksson, S. T., and Hudson, M. S., Oscillating Pressure Treatment of 10 U. S. Woods, 6: 275. (No. 1912—$1.00)
Blackford, J. M., Separating Bark From Wood Chips, 11: 515. (No. 1885—$1.00)
Blomquist, R. F., Progress in 1960—Glues and Gluing Processes, 2: 77. (No. 1863—$1.00)
Bollen, W. B., and Glennie, D. W., Sawdust, Bark and Other Wood Wastes For Soil Conditioning and Mulching, 1: 38. (No. 1639—$1.00)
Breuer, R. J., *see* Anderson, A. B.
Bruce, R. W., Factors Affecting Sawmill Output, 10: 471. (No. 1901—$1.00)
Burch, J. E., and Colley, R. H., A New Method for Characterizing Mixtures of Creosote and Petroleum Oils, 4: 197. (No. 1848—$.80)
Burch, J. E., *see* Reynolds, G.
Burrows, C. H., Some Factors Affecting Resin Efficiency in Flake Board, 1: 27. (No. 1796—$1.00)

C

Camarano, A. M., The Marketing of Lumber and Forest Products to the Government, 9: 428. (No. 1936—$1.00)
Campbell, G. S., The Value of Presteaming—For Drying Some Collapse-Susceptible Eucalypts, 8: 341. (No. 1892—$1.00)
Carroll, M., Simplified Data-Handling Techniques for Particle Board and Hardboard, 3: 149. (No. 1734—$1.00)
Carruthers, J. F. S., and Hudson, R. W., Varying Moisture Content of Mechanically Dried Veneers, 7: 293. (No. 1867—$.80)
Carstensen, J. P., Gluing Characteristics of Softwood Veneers and Secondary Western Hardwood, 7: 313. (No. 1922—$.60)
Cass, S. B., Jr., A Comparison of Hot Press Interior Plywood Adhesives, 7: 285. (No. 1829—$.60)
Clapham, J. C., and Lambe, T. A., An Operations-Research Approach to Lumber Sorting, 4: 181. (No. 1830—$.80)
Clapham, J. C., and Lambe, T. A., The Economics of Automatic Lumber Sorting, 7: 320. (No. 1907—$.80)
Clark, J. W., Natural Decay Resistance of Alerce, 3: 127. (No. 1666—$.40)
Colley, R. H., *see* Burch, J. E.
Core, H. A., Côté, W. A., Jr., and Day, A. C., Characteristics of Compression Wood in Some Native Conifers, 8: 356. (No. 1914—$1.00)
Côté, W. A., Jr., *see* Core, H. A.
Crosby, J. N., Performance of Some Blister-Resistant Paints, 6: 255. (No. 1852—$.60)

D

Day, A. C., *see* Core, H. A.
DeKoning, E. W., Automate Your Lumber Sorting, 4: 178. (No. 1642—$.60)
Dosker, C. D., Product Development—Keystone to Expanded Markets, 9: 423. (No. 1963—$.60)
Dougherty, R. B., Particleboard—Today and Tomorrow, 9: 433. (No. 1916—$.60)
Doughty, J. B., *see* Stine, I. A.
Doyle, J. A., Progress in Logging—1960, 2: 49. (No. 1859—$1.00)
Dreher, W. A., *see* Goldstein, I. S.
Dreher, W. A., *see* Goldstein, I. S.
Duffield, J. W., Progress and Problems of Genetic Improvement of Wood Quality, 5: 211. (No. 1819—$.60)

E

Ellwood, E. L., Progress in Wood Drying—1960, 2: 55. (No. 1861—$1.00)
Eslyn, W. E., *see* Scheffer, T. C.
Eslyn, W. E., *see* Scheffer, T. C.

F

Fearing, W. B., *see* Anderson, A. B.
Freeman, S. W., The Corporate Image of Furniture Manufacturing, 8: 340. (No. 1944—$.60)
Fuller, R. G., Evaluation of Two Bisphenols as Wood-Preservative Agents, 4: 193. (No. 1762—$.80)

G

Garnum, E., *see* Locke, E. G.
Glennie, D. W., *see* Bollen, W. B.
Goldstein, I. S., and Dreher, W. A., A Non-Hygroscopic Fire Retardant Treatment for Wood, 5: 235. (No. 1855—$.60)
Goldstein, I. S., Dreher, W. A., and Jeroski, E. B., Preservative Action of Bound Copper and Zinc, 3: 128. (No. 1802—$.60)
Goldstein, I. S., Jeroski, E. B., Lund, A. E., Nielson, J. F., and Weaver, J. W., Acetylation of Wood in Lumber Thickness 8: 363. (No. 1877—$1.00)
Goodwin, D. R., and Hug, R. E., A New Wood Preserving Process, 11: 504. (No. 1949—$.80)

H

Hale, T. F., Commercial Hardwood Veneer Drying—Variables and Laboratory Correlation, 9: 420. (No. 1875—$.60)
Hamilton, J. F., The End-Use Approach to Particle Board Standards, 5: 234. (No. 1775—$.40)
Hamilton, J. R., Variation of Wood Properties in Southern Red Oak, 6: 267. (No. 1823—$1.00)
Hancock, W. V., and Northcott, P. N., Microscopic Identification of Undercured Glue Bonds in Plywood, 7: 316. (No. 1946—$.80)
Harrell, C., *see* Smith, G. W.
Harris, J. F., and Smuk, J. M., Economics of the Production of Furfural from Xylose Solutions, 7: 303. (No. 1945—$1.00)
Heebink, B. G., Paper Overlaid Lumber, 4: 167. (No. 1851—$1.00)
Henriksson, S. T., *see* Blew, J. O.
Heritage, C. C., The Interrelation of Government and Private Research, 12: 586. (No. 956—$.80)
Herrick, D. E., and Phelps, R. B., New Houses: How Many are Built With Wood?, 11: 544.
Hood, A. B., Revitalization Through Modern Marketing, 9: 426. (No. 1962—$.60)
Hoyle, R. J., A Nondestructive Test for Stiffness of Structural Lumber, 6: 251. (No. 1919—$.80)
Hudson, M. S., *see* Blew, J. O., Jr.
Hudson, R. W., *see* Carruthers, J. F. S.
Hug, R. E., *see* Goodwin, D. R.
Huxster, W. T., Jr., *see* Keppler, W. E.

I

Ishaq, S. M., *see* Tarkow, H.
Iversen, E. S., *see* Mitchell, H. L.

J

Jackson, N. D., and Smith, G. W., Linear Programming in Lumber Production, 6: 272. (No. 1792—$.60)
James, W. L., Effect of Temperature and Moisture Content on: Internal Friction and Speed of Sound in Douglas-fir, 9: 383. (No. 1884—$1.00)
Jenkins, E. H., The Lumber Industry: New Leadership, 7: 297. (No. 1927—$.60)
Jeroski, E. B., *see* Goldstein, I. S.
Jeroski, E. B., *see* Goldstein, I. S.
Johnson, C. M., People, Trees and Directions, 3: 139. (No. 1652—$.60)
Johnson, E. S., and Shook, E. A., Economics of Machine Replacement, 10: 467. (No. 1906—$.80)
Jorgensen, R. N., A First-Hand Report on The Latin American Forestry Institute, 7: 330.
Jorgensen, R. N., and Murphey, W. K., Effect of Particle Geometry and Resin Spread on Glue-Line Thickness and Distribution, 12: 582. (No. 1952—$.80)
Jorgensen, R. N., and Odell, R. L., Dimensional Stability of Oak Flake Board As Affected by Particle Geometry and Resin Spread, 10: 463. (No. 1934—$.80)

K

Kauman, W. G., Effect of Thermal Degradation on Shrinkage and Collapse of Wood from 3 Australian Species, 9: 445. (No. 1891—$1.00)
Keith, C. T., Characteristics of Annual Rings in Relation to Wood Quality for White Spruce, 3: 122. (No. 1824—$1.00)
Keppler, W. E., and Huxster, W. T., Jr., Costs—A Key to Sawmill Profits, 9: 435. (No. 1948—$1.00)
Kersavage, P. C., *see* Schniewind, A. P.
King, E. G., Jr., Time-Dependent Strain Behavior of Wood in Tension Parallel to the Grain, 3: 156. (No. 1821—$1.00)
Koch, P., *see* Stutz, R. E.
Kollmann, F. F. P., High Temperature Drying: Research, Application, and Experience in Germany, 11: 508. (No. 1890—$1.00)

Krahmer, R. L., Anatomical Features of Permeable and Refractory Douglas-fir, 9: 439. (No. 1795—$.60)
Krueger, J., *see* Tarkow, H.
Kuebler, H., Drying Stresses in Veneer and Their Relief, 7: 324. (No. 1869—$1.00)
Kunesh, R. H., The Inelastic Behavior of Wood: A New Concept for Improved Panel Forming Processes, 9: 395. (No. 1961—$1.00)

L

Lambe, T. A., *see* Clapham, J. C.
Lambuth, A. L., Pre-Pressing Plywood Assemblies, 9: 416. (No. 1911—$.80)
Leach, C. W., *see* Smeal, T. W.
Lee, C. L., Crystallinity of Wood Cellulose Fibers Studied by X-Ray Methods, 2: 108. (No. 1797—$1.00)
Locke, E. G., and Garnum, E., FAO Technical Panel on Wood Chemistry: Working Party on Wood Hydrolysis, 8: 380. (No. 1983—$.60)
Loos, W. E., Applications of the Gamma-Ray Backscatter Technique to the Inspection of Utility Poles, 8: 333. (No. 1926—$.60)
Loos, W. E., The Relationship Between Gamma Ray Absorption and Wood Moisture Content and Density, 3: 145. (No. 1782—$1.00)
Lund, A. E., *see* Goldstein, I. S.

M

Madhosingh, C., Tolerance of Some Fungi to a Water-Soluble Preservative and its Components, 1: 20. (No. 1722—$.60)
Mark, R., Wood-Aluminum Beams Within and Beyond the Elastic Range. I. Rectangular Sections, 10: 477. (No. 1964—$1.00)
McCutcheon, J. O., Pertinent Developments in Continuous Pulping Systems, 4: 185. (No. 1665—$1.00)
McMahon, E., Applying Cumulative Frequency Distribution in Moisture Control During Kiln Drying, 3: 133. (No. 1610—$1.00)
Miller, D. J., Oregon Woods for Crossties, 12: 579. (No. 1966—$.60)
Miller, D. J., Permeability of Douglas-Fir in Oregon, 1: 14. (No. 1764—$.60)
Miller, R. L., *see* Saucier, J. R.
Miniutti, V. P., Mraz, E. A., and Black, J. M., Measuring the Effectiveness of Water-Repellent Preservatives, 10: 453. (No. 1959—$1.00)
Mitchell, H. L., and Iversen, E. S., Seasoning Green-Wood Carvings With Polyethylene Glycol-1000, 1: 7. (No. 1845—$.40)
Moore, W. E., and Beglinger, E. A., A Method of Charcoal Analysis, 1: 17. (No. 1739—$.60)
Moslemi, A. A., Resistance of Casein Glue Joints to Shear Fatigue Stressing, 3: 115. (No. 1781—$1.00)
Murphey, W. K., *see* Jorgensen, R. N.
Mraz, E. A., *see* Miniutti, V. P.

N

Nelson, R. M., Jr., *see* Stamm, A. J.
Nicholls, G. A., *see* Anderson, A. B.
Nielson, J. F., *see* Goldstein, I. S.
Northcott, P. N., *see* Hancock, W. V.

O

Odell, R. L., *see* Jorgensen, R. N.
Oldham, M. L., *see* Stutz, R. E.

P

Page, R. H., Weight as a Measure of Volume for Southern Yellow Pine Lumber, 7: 300. (No. 1887—$.60)
Pankevicius, E., Influence of Position in Tree on Recoverable Collapse in Wood, 3: 131. (No. 1825—$.40)
Partridge, A. D., Fumigants Kill The Oak Wilt Fungus In Wood, 1: 12. (No. 1735—$.60)
Pearl, I. A., and Beyer, D. L., Studies on Lignin and Related Products. XV. Lignosulfonates of Birch Spent Sulfite Liquor, 9: 442. (No. 1871—$.60)
Pearl, I. A., *see* Rowe, J. W.
Peterson, M. K., Plywood in the Sixties, 6: 245. (No. 1837—$.60)
Phelps, R. B., *see* Herrick, D. E.
Picton, J. W., Production with Polyester Finishes, 7: 283. (No. 1843—$.60)
Post, P. W., Relationship of Flake Size and Resin Content to Mechanical and Dimensional Properties of Flake Board, 1: 34. (No. 1584—$.80)

R

Rankin, J. W., Research Challenges Corporate Management, 5: 232. (No. 1828—$.40)
Rendall, R. R., The Application of Hardboards in Construction, 6: 248. (No. 1720—$.60)
Reynolds, G. and Burch, J. E., Biological Significance of ODPN-Insoluble and Glycol-Insoluble Tests, 4: 201. (No. 1849—$.40)
Rietz, R. C., Accelerated Weathering of Red Oak Treated With Various Preservtives Used to Treat Crossties, 12: 567. (No. 1924—$1.00)
Rollins, M. L., and Tripp, V. W., The Architecture of Cellulose: A Microscopic Review, 11: 493. (No. 1883—$1.00)
Rowe, J. W., and Pearl, I. A., A Review of Progress in Chemical Conversion, 2: 85. (No. 1864—$1.00)
Rucker, T. W., and Smith, W. R., Forced-Air Drying of Lumber—Research and Experimental, 9: 390. (No. 1905—$1.00)

S

Samuels, R., Magnefite Pulping of Douglas-fir, 3: 119. (No. 1644—$.60)
Sardo, W. H., Jr., Wooden Pallets and Pallet Containers: Present and Future Markets, 12: 576. (No. 1935—$.80)
Saucier, J. R., and Miller, R. L., Deterioration of Southern Pine Chips in Summer and Winter Storage, 8: 371. (No. 1874—$1.00)
Saums, W. A., and Turner, H. D., Accelerated Test for Measuring Lateral Dimensional Change of Wood-Based Panels, 9: 406. (No. 1953—$.60)
Scheffer, T. C., and Eslyn, W. E., Effect of Heat on the Decay Resistance of Wood, 10: 485. (No. 1950—$1.00)
Scheffer, T. C. and Eslyn, W. E., Natural Decay Resistance of Guijo, 6: 282. (No. 1879—$.20)
Schniewind, A. P., and Kersavage, P. C., A Quantitative Evaluation of Second Order Drying Stresses, 11: 523. (No. 1886—$1.00)
Sherrill, R. W., *see* Whitehead, T. H.
Shook, E. A., *see* Johnson, E. S.
Sisterhenm, G. H., Evaluation of an Oil-Fired Veneer Dryer—Its Effect on Glue Bond Quality, 5: 207. (No. 1807—$1.00)
Smeal, T. W., Wolfson, M. L., and Leach, C. W., Hot- and Cold-Solvent Techniques for Creosote Extraction, 9: 409. (No. 1954—$1.00)
Smith, G. W., and Harrell, C., Linear Programming in Log Production, 1: 8. (No. 1659—$.80)
Smith, W. G., *see* Jackson, N. D.
Smith, W. R., Building Homes to Withstand Hurricane Damage, 4: 176. (No. 1838—$.40)
Smith, W. R., *see* Rucker, T. W.
Smuk, J. M., *see* Harris, J. F.
Stamm, A. J., A Comparison of Three Methods for Determining the pH of Wood and Paper, 7: 310. (No. 1868—$.60)
Stamm, A. J., and Nelson, R. M., Jr., Comparison Between Measured and Theoretical Drying Diffusion Coefficients for Southern Pine, 11: 536. (No. 1882—$1.00)
Stamm, A. J., and Wagner, E., Determining the Distribution of Interstructural Openings in Wood, 3: 141. (No. 1624—$.80)
Stevens, W. C., Distortions of Wood: Drying With and Without Restraint, 8: 348. (No. 1965—$1.00)
Stine, I. A., and Doughty, J. B., Gas Chromatography for Tall Oil and Turpentine Analysis, 11: 530. (No. 1878—$1.00)
Stranks, D. W., Utilization of Aspen Wood Residues, 7: 288. (No. 1880—$1.00)
Stutz, R. E., Koch, P., and Oldham, M. L., Control of Brown Stain in Eastern White Pine, 6: 258. (No. 1854—$.60)

T

Takamoto, H., A New Water-Borne Preservative: Ammonium-Copper Pentachlorophenolate, 5: 229. (No. 1463—$.60)
Tarkow, H., and Ishaq, S. M., Effectiveness of Stabilized Surface Layers of Wood as Moisture Barriers, 4: 203. (No. 1741—$.40)
Tarkow, H., and Krueger, J., Distribution of Hot-Water Soluble Material in Cell Walls and Cavities of Redwood, 5: 228. (No. 1749—$.40)
Taylor, N. D., Business Education and the Forest Industries, 6: 264. (No. 1876—$.60)
Tripp, V. W., *see* Rollins, M. L.
Troxell, H. E., Progress in Wood Preservation, 1959–1960, 2: 67. (No. 1862—$1.00)
Turner, H. D., *see* Saums, W. A.

V

Verrall, A. F., Brush, Dip, and Soak Treatments With Water-Repellent Preservatives, 1: 23. (No. 1770—$.80)

W

Wagner, E., *see* Stamm, A. J.
Walling, W. C., Hardboard—State of the Industry and Its Use Practice, 11: 519. (No. 1955—$.80)
Weaver, J. W., *see* Goldstein, I. S.
Whitehead, T. H., and Sherrill, R. W., A Physico-Chemical Study: Wood Charcoal From a Cinder Block Kiln, 8: 336. (No. 1872—$.80)
Williston, E. M., Commercialization of Research Results, 4: 190. (No. 1646—$.60)
Wilson, J. D., Holocellulose Determinations of Mountain Hemlock Bark, 6: 260. (No. 1779—$.80)
Wolfson, M. L., *see* Smeal, T. W.

Y

Youngs, R. L., Recent Progress Toward An Understanding of the Physical and Mechanical Properties of Wood, 5: 214. (No. 1925—$1.00)

NAMES in the NEWS

Two awards for outstanding achievement in biological research contributing to the advancement of forestry were made to **Dr. R. E. Balch** of Fredericton, New Brunswick, and **Dr. Paul J. Kramer** of Durham, N. C. The presentations were made by President Charles A. Connaughton of the Society of American Foresters during a combined annual meeting with the Canadian Institute of Forestry.

William R. Miles has been appointed extension forester for the University of Minnesota Agricultural Extension Service. Mr. Miles succeeds **Parker Anderson** who retired this year after 36 years as extension forester.

Mill Equipment, Inc., Seattle manufacturer of Selectric sawmill machinery, has named **Donald Pease** as assistant manager.

Dr. Frederick D. Ezekiel has been named general manager of American Measurement and Control, Inc., and **Jack H. Bernstein** has been appointed general manager of CompuDyne Electronics, Inc. Both organizations are subsidiaries of CompuDyne Corporation.

Bronson J. Lewis has been appointed assistant to the secretary of the Douglas Fir Plywood Association. Mr. Lewis is already widely known in the industry, especially for his activity in the field of independent and worker-owned mills.

James B. Wiseman has been named a vice president of E. L. Bruce Co., Memphis, Tenn. Bruce recently merged with Empire National Corporation of New York.

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E-435—Want outstanding TV-phono-radio cabinet designer to take charge of major manufacturer's styling requirements. Creativity plus knowledge of manufacturing processes and costs essential. High compensation plus very liberal fringe benefits. Desirable Midwest location. (Dec. & Jan.)

Employment Wanted

655—Chief Executive officer of wood products manufacturing and distributing firm, seeks new challenge in sales, training, or public relations. Would retain financial interest in current company. B.S. degree. Heavy experience in wood mouldings, interior trim, sales to lumber dealers. (Nov. and Dec.)

656—Wood technologist, B.S. and M.F. from eastern university, desires to relocate in east or southeast. Eight years' experience includes cabinet production, glues, plastic laminates, particleboard, wood preservation, and public relations. Desires supervision in production, applied research, or forest-plant utilization problems. Married, 2 children, age 39. (Nov. and Dec.)

657—Wood utilization major, B. in forestry from Virginia Univer sity, desires position in wood-using industry or related field. Will graduate Feb., 1962, 23 years of age, married, one child, no military obligation. Will consider any position offered, and will be available for work immediately. Civilian pilot's license. (Nov. and Dec.)

658—Desires position in production, quality control, development, or management. 1961 graduate of Iowa State University, B.S. in wood utilization. Completed military obligation, age 26, 3 children, available November 1. (Nov. and Dec.)

659—Position wanted in lumber, plywood, or related industries in production or quality control, management studies, technical service, or product development. Twelve years' experience in lumber and plywood, B.S. in Forest Products. Thoroughly familiar with these phases in Western operations. Age 37, mar- year.

660—Position wanted in woodworking industry. Experience in lumber manufacturing, grading, kiln drying, and familiar with woodworking machinery. Have experience in supervision and management of men in all previous positions. B.S. in Wood Engineering, age 29, married. Would prefer Northeast or Midwest. (Dec. and Jan.)

661—Wood technologist, M.S. degree, 5 years progressive experience in large federal research laboratory, desires a responsible challenging position in research and development or management. Prefers South or Southwest area. (Dec. & Jan.)

662—Wood technologist to receive M.S. from Michigan State University (B.S. Forestry), desires production management or applied research position with progressive company. Married, age 32, available in March 1962. (Dec. & Jan.)

Manufacturer of white oak whiskey barrels with considerable solid and divided wood waste seeks capable person to develop profitable byproducts of the waste. Must be capable of product development, trustworthy economic analysis, processing, and marketing. Company of low. seven figure worth, approx. 300 employees.

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Good opportunity for the right man. Sales experience preferred. Knowledge of wood work gluing important but not essential. Will train and provide car and travel expenses. Straight salary to start. Territory will be mid-South. Prefer resident of that area. All applications will be considered confidential.

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1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	1947–51 Proceedings			

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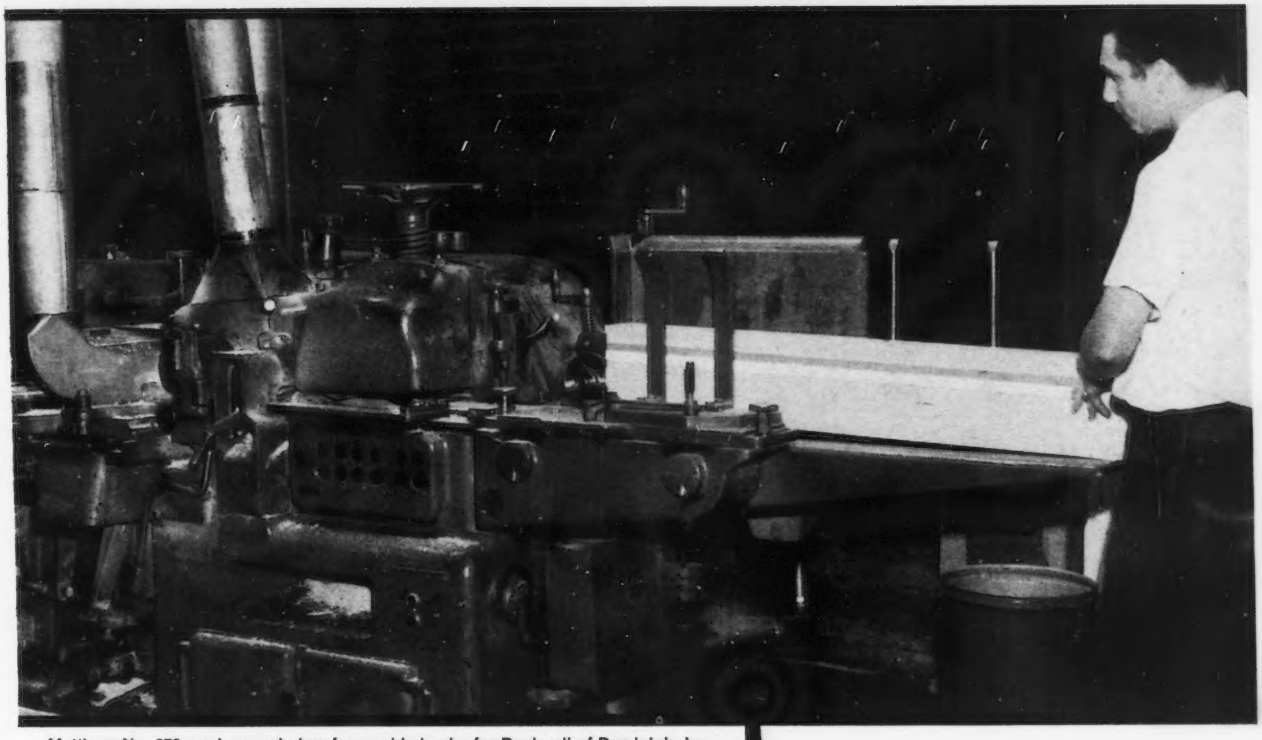
PRESTIGE-QUALITY MOULDERS
...plenty particular about accuracy



Mattison No. 276 produces window frame side jambs for Rockwell of Randolph, Inc.

Versatile Mattison moulders aren't too fussy about the type of design they work on, but they're plenty particular about accuracy! So when Rockwell of Randolph, Inc., invests in four Mattison No. 276 Moulders, they receive more than mere machines. Precise accuracy, extra production, and exceptionally low stock loss are the real investments . . . and each pays off by canceling unnecessary moulding costs. Here's why.

More precision—Mattison's vibration-free moulder operation and close-coupled cutterheads assure accurate mouldings of delicate contours. Exact alignment between bearings maintains cutterhead concentricity.

Production efficiency—Mattison's wide ranges of feed speeds and automatic feeds are equally efficient in hard or soft woods. Easy, quick setups further cut hidden nonproductive costs to a minimum.

Less stock loss—Mattison's trackless, nonsagging feed chain assures better traction with less roll pressure, carries the lightest and most frail stock through for delicate, high-quality moulding. Discards—*and* wasted production costs—are virtually eliminated.

Write for complete data on Mattison Moulders.

SPECIFICATIONS

Finish size capacity	6" x 4"
Rough size capacity	6½" x 4¼"
Maximum speed	7200 rpm
Rates of feed	23, 38, 46, 54, 76, 80, 109, 160 ft/min

MATTISON MACHINE WORKS ROCKFORD, ILL. U.S.A.

MATTISON
WOODWORKING MACHINERY

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Please send literature describing your No. 276 Electric Moulder.

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On behalf of the Executive Board and the staff members at the Society's National Office in Madison, I extend to all members and friends of the Forest Products Research Society our sincere wishes for a joyous Holiday Season and a prosperous New Year.

D. K. SAUNDERS President

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